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SUBACUTE PNEUMONIA IN CHILDREN

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FOR many years on the Children's Medical Service of Bellevue Hospital we have recognized a form of pneumonia, the clinical features of which do not correspond with any of the varieties whose pathology we know, and which, for lack of a better term, we call "subacute pneumonia." We are not presenting it as a new clinical entity. Riesman[1, 2] described similar cases in 1913 as "chronic bronchopneumonia" and again in 1934 as "a lobar form of bronchopneumonia." Remé[3] described a small group of cases which closely resemble ours, and which she termed "creeping subacute pneumonia." Some of the cases described by Smiley et al.[4] as "acute interstitial pneumonia" may fall into the group we are discussing, as may some of the cases described as atypical pneumonias by Kellner.[5]

We first recognized the clinical picture of subacute pneumonia during the years 1922-1930 while we were making an intensive study of sinusitis in children. Soon we began to recognize on the ward the more serious and prolonged forms of this disease. We are calling attention again to its clinical picture because we believe that the importance of these cases in children has not been sufficiently emphasized.

The type of subacute pneumonia which we shall describe has many characteristic features. Riesman speaks of "the peculiar, almost specific character of the disease." Every year after we show our students a few marked cases on the wards, they begin to recognize cases in the Outpatient Department.

These subacute pneumonias are always accompanied and often preceded by symptoms of respiratory infection, sometimes a nasopharyngitis, often a sinusitis. There is the usual story of a cold, with nasal obstruction or discharge, and some cough. After a period of days or weeks the cough suddenly becomes worse and more productive. This

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change is accompanied by a rise in temperature, usually not very high. There is often pain in the chest, worse on inspiration or cough.

In one group of cases, which is small, the onset is so acute and the fever so high that a pneumococcus lobar pneumonia is suggested during the first hospital days. In a second and larger group, where there is a history of recurring attacks, a diagnosis of acute pneumonitis surrounding an area of fibrosis with bronchiectasis may be suggested by the nature of the symptoms and by the extent of the physical signs. In the largest group of cases the patients are usually first seen in the Outpatient Department, and the diagnosis points at first to a bronchosinusitis. A careful history and physical examination, however, suggest a subacute pneumonia, and the diagnosis is confirmed by roentgenogram.

The physical signs on first examination are usually dullness and diminished breath sounds at one or both bases with a few râles. As the disease progresses, resonant râles appear, and numerous râles with this quality are the most characteristic signs of well-marked cases. In some instances definite bronchial or bronchocavernous breath sounds are heard over the involved area, usually at the bases of the lungs. The signs are usually bilateral in severe cases, and even in mild ones a few râles are usually heard on the opposite side from the main pneumonia. There is no relation between the extent of the signs and the acuteness of the onset and febrile period.

The characteristic roentgenographic picture is an irregular shadow extending from the hilar region, usually along the cardiac border and across the diaphragm, often obliterating the costophrenic angle. The shadow is not as homogeneous as that of a lobar pneumonia and often shows bronchial streaking. In some cases there is an uneven mottling. On the lateral view the lesion is usually seen in the retrocardiac space. There is not the tendency for the shadow to hug the great fissure which is regularly seen in lateral views of lobar pneumonia. In mild cases the outline of the diaphragm is almost clear, but the characteristic infiltration along the cardiac border is present and usually the cardiohepatic angle is obliterated. There may be enlargement of the nodes in the hilar region.

A moderate leucocytosis with predominance of neutrophiles is usually present, even in cases with apparently little involvement of the lungs. One of the characteristics of the type of subacute pneumonia we are discussing is that the white count usually remains elevated after the lesion begins to clear and rarely falls to normal before two or three weeks. In this persistent leucocytosis subacute pneumonia differs from lobar pneumonia where the white count usually falls with the defervescence.

The sputum is usually frankly purulent, varying in amount from a few drams to 8 oz. or more. The amount of sputum at onset is usually striking and offers another contrast to other types of pneumonia in children, in which sputum is difficult to obtain early in the course of the disease. Many organisms are present, but it is unusual to find the

types of pneumococci usually associated with lobar pneumonia in children. Possibly because of the tenacious exudate and inflammatory edema of the bronchi, collapse of a portion of a lobe or of an entire lobe may take place. This occurrence is not necessarily related to the extent of the pneumonic process.

The term "subacute" aptly describes the onset and course of most cases. It is impossible to classify them according to degree. We see some in which there are no marked symptoms at onset, and neither x-ray findings nor the signs foretell a long course, and yet it is months before the chest is entirely clear. On the other hand, we see patients with an acute onset like a pneumonia which goes into a subacute phase and clears entirely in five or six weeks. An occasional case clears in two to three weeks. We have seen cases last five months and eventually clear, with subsequent normal bronchograms. The fever may last only a day or two, with an occasional rise thereafter to 101° F. When the fever is high at the onset, it may persist for a week or two, occasionally longer.

The prognosis for life is invariably good in our experience. Severe cases of this type of pneumonia, especially when associated with a collapsed lobe or with severe pleurisy, may lead to bronchiectasis during the course of the pneumonia, but in general, recovery is complete as far as can be determined. However, the prognosis of a single attack of subacute pneumonia cannot be immediately evaluated. It depends partly on the amount of damage to the lung, and partly on the character and extent of the upper respiratory infection. These pneumonias may recur after severe attacks, even where bronchography is normal. Children seem to outgrow the tendency to repeated pneumonia, possibly because the area of damaged lung becomes less in relation to the normal lung tissues as the child grows.

Differential diagnosis between subacute pneumonia of this type and bronchiectasis is very important. It is true that the past histories of subacute pneumonia and bronchiectasis often show a striking similarity. In both there is a high incidence of preceding pneumonias or of severe attacks of disease predisposing to pneumonia, such as measles and pertussis. Often, in prolonged cases, it is the course alone, leading to resolution and a normal bronchogram, which distinguishes subacute pneumonia from pneumonitis surrounding an area of bronchiectasis.

Severe cases are sometimes confused in diagnosis with tuberculosis, but the differentiation should be easy. The roentgenologic picture could only represent a tuberculous bronchopneumonia. Bronchogenic spread of such extent would come from a source which should give physical signs or be visible on roentgenogram, for instance, a cavity or an active tuberculous focus above the area of pneumonia. The sputum would contain tubercle bacilli, the fever would be more persistent, the leucocytosis would be uncommon. Moreover, the tuberculin test may be negative in subacute pneumonia.

The mild cases must be distinguished from a simple sinusitis and from the so-called bronchosinusitis cases. In many cases the low-grade fever and the prominence of signs and symptoms referable to the upper respiratory tract might lead one to overlook the lung findings unless a careful examination of the chest is made. The resonant râles, even if few in number and especially if localized, always indicate that one is dealing with more than a bronchitis. A roentgenogram completes the diagnosis of subacute pneumonia by showing a denser and more extensive shadow than the simple streaking which accompanies bronchosinusitis. The extent of the roentgenologic shadow may be in marked contrast to the meager signs.

ANALYSIS OF 100 CASES

As we have said above, these cases differ mainly in degree. The recital of the histories, physical examinations, and roentgenograms of a number of cases of subacute pneumonia only emphasizes the monotonous similarity of the stories. As a check to our clinical judgment we have taken 100 cases from the files of the Chest Clinic of the Children's Medical Service. This clinic cares for the children with chronic lung disease on the wards and in the Outpatient Department. Some of the mild and moderate cases included in this series were diagnosed while the study of sinusitis in children was being made in 1922-1930. Others have been seen subsequently in the clinic and on the wards. The first marked cases we found were referred to the Chest Clinic as cases of bronchiectasis. Cases with acute onsets were referred by the pneumonia service when it became obvious the diagnosis was not lobar pneumonia.

This group does not consist of consecutive cases, but represents a sampling of a much larger group. An effort has been made for teaching purposes to keep records of cases with differing grades of severity; otherwise there was no selection of cases.

TABLE I

AGE GROUPS

AGE IN YEARS	NUMBER OF CASES
2	2
3	6
4	5
5	9
6	13
7	16
8	9
9	12
10	12
11	8
12	3
13	2
14	2
15	1

Of the 100 patients, 57 were boys and 43 girls. Ninety per cent were white. The age distribution of our patients is shown in Table I. There was a history of previous pneumonia in forty-five patients, and sixteen of these had two or more attacks. Sixty-nine gave a history of marked frequency of colds. All the children had upper respiratory infections on first examination. In eighty-five patients there was sufficient clinical evidence of sinusitis to warrant roentgenologic examination, and x-ray films showed definite pathology of the sinuses in sixty-one of these. Forty-one patients complained spontaneously of chest pain. All of them coughed, and in seventy-seven the cough was definitely productive. In forty-one there were bilateral chest signs with dullness and resonant râles, but only twenty-three of these showed bilateral pathology on the roentgenogram. Although any part of the lung may be affected, most characteristically the lesion is basal, with involvement slightly more common on the right. The distribution according to lobes is shown in Table II. The average total illness of our 100 cases was seven weeks.

TABLE II

FREQUENCY OF INVOLVEMENT OF LOBES AS SHOWN ON ROENTGENOGRAM

LOBE	TIMES INVOLVED*
Left upper	2
Right upper	14
Right middle	5
Left lower	61
Right lower	67

*Some of these patients had involvement of two or more lobes.

In sixty-three patients the chest signs cleared before the x-ray findings became negative. All of the patients in this series of 100 cases went on to apparently complete resolution of the pneumonia. Bronchography was done on most of the prolonged cases and on some shorter and milder ones. Negative bronchograms were obtained on twenty-four patients.

Only eighteen patients had white cell counts of 20,000 or over. Most of the white counts ranged around 15,000. In twenty cases pneumococci were isolated from the throat, but in seven they were unclassified. A sputum culture was done in forty-one patients and invariably showed a profusion of organisms. Hemolytic streptococci were isolated only five times, always in marked cases.

Collapse of a lobe occurred in ten patients. This happened seven times in the lower lobes and three times in the right middle lobe. Reaeration took place in all instances. All patients discharged from the ward were subsequently seen in the Outpatient Department. Of these, forty-six were followed for two years or more, the majority for four years, and a few as long as eight or nine years. During this period fifteen patients had one or more recurrences of subacute pneumonia.

TREATMENT

Even patients with the mildest cases should be put to bed. Treatment of the upper respiratory infection should be carried out by maintaining free drainage from the nose by means of weak aqueous adrenalin or ephedrine solutions. In stubborn cases suction may have to be used. When the sinuses are markedly involved, more drastic treatments may occasionally be necessary. As soon as the acute febrile phase is over, the lung itself is drained by postural drainage, beginning with one-half minute and increasing to five minutes three times daily. This procedure must be done properly with the chest completely inverted. In children with prolonged and severe pneumonia frequent bronchoscopy may be needed to secure adequate drainage, and in cases where a lobe is collapsed, bronchoscopy should always be done. If the pneumonia tends to recur in spite of treatment of the sinuses, removal of tonsils and adenoids, and general hygienic measures, climatic treatment may be necessary to reduce the incidence of colds.

	J.C. AGE 9 YRS. ADM. 12-9-35								
HIST.	PERSISTENT DRY COUGH 9 MOS. HEAD COLD, FEVER 12 DAYS								
WKS.	2 WKS. AT HOME	3	4	5	6	7	8	9	10
104 103 102 101 100 99 98 97	FEVER LOW 1 WK. HIGH 5 DAS.					NORMAL			
W.B.C. POLYS.		16,500 81%	14,140 78%	13,800 76%		10,400 45%		10,350 62%	9,700 70%
SYMPTS	COUGH + + NASAL DISCHG. + CYANOSIS +	+ + + +	+ + + 0 0	+ +	+ +	+	0		
SIGNS		L. BASE FLATNESS BR-CAV. B.S. FEW RALES R. BASE DULLNESS + DIM., B.S. + RES. RALES +	DULLNESS + RES. RALES	+ + + + + + +	0 0 + 0 0 +	0 0			
		PNEUMO. TYPE V		MANTOUX NEG. 1 MG.		SPUTUM CULTURE = STREP. VIRIDANS +			
TRTMT.	POSTURAL DRAINAGE			15 CC. DAILY	30 CC.	8 CC.	0		

Chart I.

We are presenting three cases which illustrate the various clinical pictures. Case 1 had a subacute pneumonia mistaken at first for lobar pneumonia (Chart I and Figs. 1, 2, and 3).

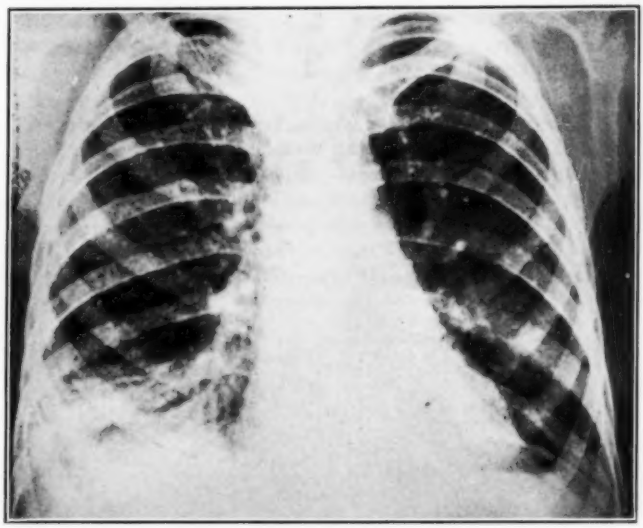


Fig. 1.—Case 1. Roentgenogram made three days after admission, showing streaking to right base obscuring outline of diaphragm.

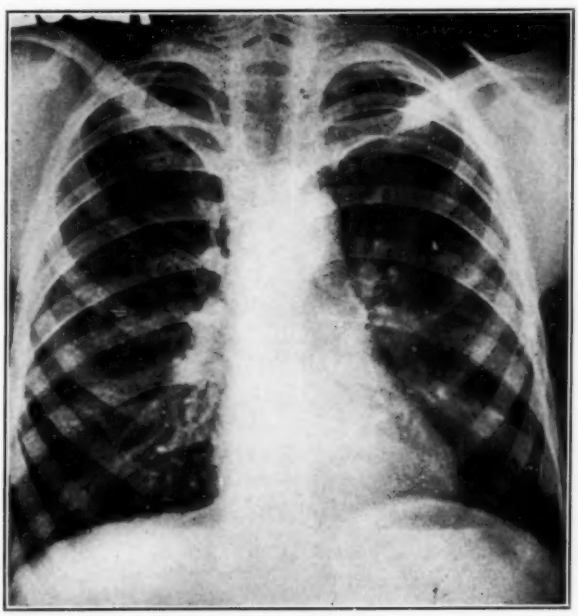


Fig. 2.—Case 1. Essentially negative roentgenogram made seven weeks after admission.

J. C., a Greek boy aged 9 years, had scarlet fever in March, 1935, followed by a persistent dry cough and weight loss. In November, 1935, he developed a fresh cold and was kept in bed. During the next twelve days he became worse; the family physician diagnosed left lower lobe pneumonia and sent the boy to Bellevue Hospital on Dec. 9, 1935.

He was acutely ill, prostrated, cyanotic, and had a temperature of 104° F. on admission. The pharynx was red, and there was a purulent anterior and posterior nasal discharge. There was limited expansion of the left chest with flatness, diminished bronchocavernous breath sounds, bronchial voice sounds and a few fine râles over the left lower lobe posteriorly. He was placed in an oxygen tent and after several days became stronger and breathed more comfortably, but the chest signs had extended to the right base. X-ray made three days after admission is shown in Fig. 1. After one week the temperature had declined to 102° F., and the

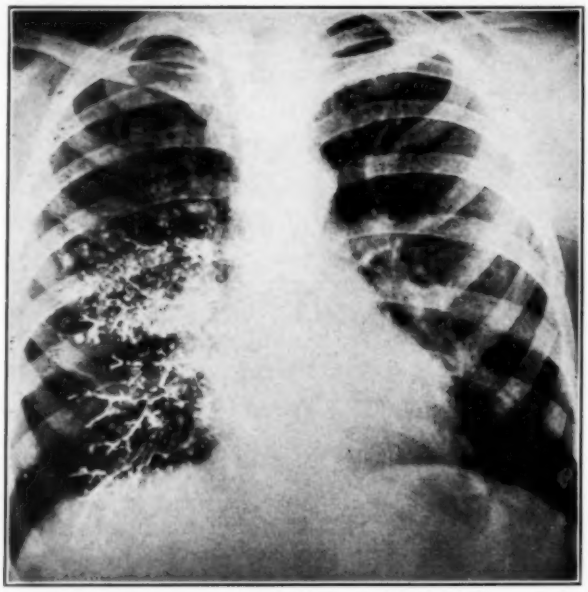


Fig. 3.—Case 1. Normal bronchogram made twelve weeks after onset of the pneumonia.

boy appeared chronically ill, but brighter. With postural drainage he was raising from 15 to 30 c.c. nonfoul green sputum daily. Seven weeks after admission the cough and expectoration had ceased, the lungs had cleared, and the roentgenologic picture was normal (Fig. 2). A bronchogram twelve weeks after onset was normal (Fig. 3). This boy has had no recurrence of his illness.

Case 2 had a subacute pneumonia mistaken at first for bronchiectasis (Chart II and Figs. 4, 5, and 6).

R. P., a white girl aged 12 years, was admitted in March, 1935, with a history of persistent cough for three weeks, which was productive of one cupful of yellow sputum daily, pain in the right chest, which was aggravated by deep breathing,

and occasional night sweats. During the previous winter she had had two similar attacks, each lasting about one week.

She was thin, undernourished, and chronically ill. On the right side there was dullness with diminished breath sounds and moist râles at both bases posteriorly. Roentgenogram made on admission is shown (Fig. 4). The temperature on admission was 100.8° F., and except for two rises to 100° F., remained normal thereafter. She was kept in bed. From 12 to 15 c.c. of yellow sputum was obtained daily on postural drainage; this gradually diminished until the cough was nonproductive. There was complete clearing of physical and x-ray signs after five weeks (Fig. 5), and a normal film was obtained after eight weeks (Fig. 6).

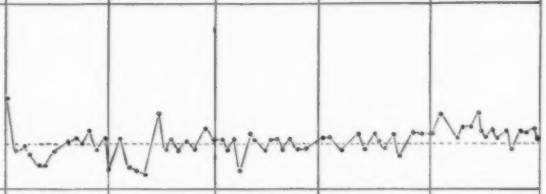
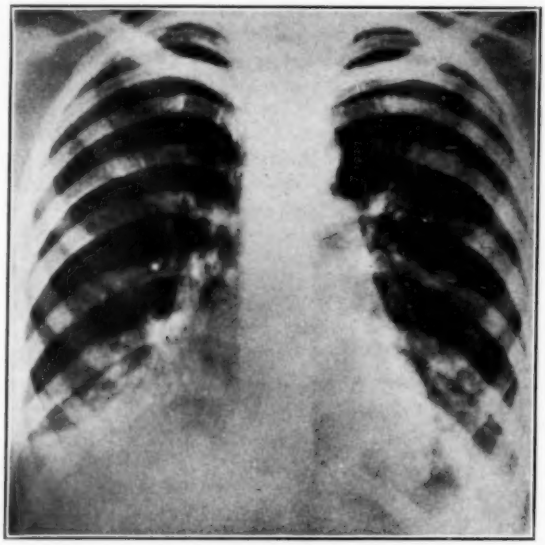
	R.P. AGE 12 YRS. ADM. 3-26-35					
HIST.	ILL DURING WINTER 34-35 LIKE PRESENT ILLNESS					
WKS.	3 WKS. AT HOME	4	5	6	7	8
104 103 102 101 100 99 98 97	NO KNOWN FEVER					
W.B.C. POLYS.		16 000 45%		6 300 51%		
SYMPTS.	COUGH SPUTUM 1 CUP DAILY CHEST PAIN R. CONSTANT. WORSE ON DEEP BREATHING. NIGHT SWEATS	++ ++ 0 0	+ + 0 0	0 + 0	+ 0	0 0
SIGNS		R.&L. BASES DULLNESS DIM. B.S. RESONANT RALES	R>L + + RALES INCR.	R + + OCCASIONAL	0 0 0 0	
		MANTOUX NEG. 1 MG.	SPUTUM CULTURE =	STREP. VIRIDANS ++ STAPH. AUREUS + DIPHTHEROIDS + FUSIFORM B. +		
TRTMT.	POSTURAL DRAINAGE		8-24 CC. DAILY	10-120 CC.	4-8 CC.	0

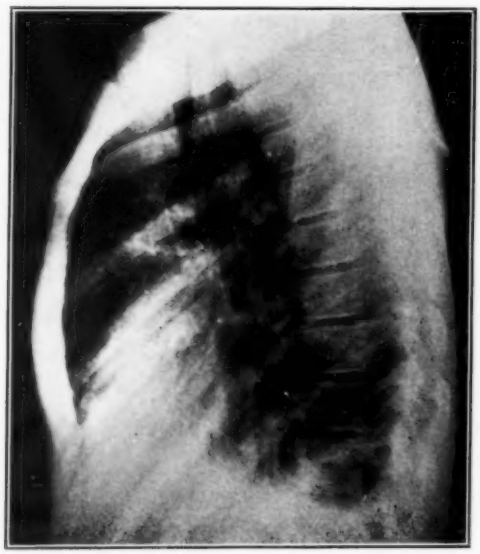
Chart II.

Case 3 had subacute pneumonia in the course of a chronic sinusitis (Chart III and Figs. 7, 8, 9, and 10).

R. L., an Italian boy aged 9 years, was admitted to Bellevue Hospital in July, 1934, with a history of head cold, slight fever, dry cough, and substernal pain of two weeks' duration. He was well nourished and not acutely ill. The nostrils were occluded with thick green mucopus, and there was also a purulent posterior nasal discharge. Roentgenologic examination showed marked clouding of right ethmoids and right antrum. There were dullness with diminished breath sounds and resonant râles over the right lower lobe posteriorly. Roentgenogram made on admission is shown in Fig. 7. After two weeks in the hospital his roent-

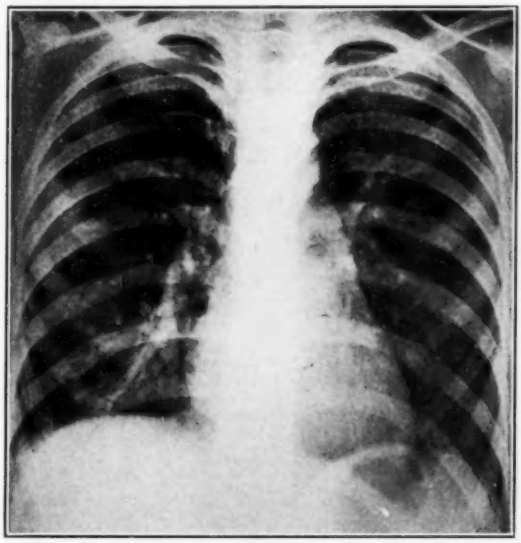


A.

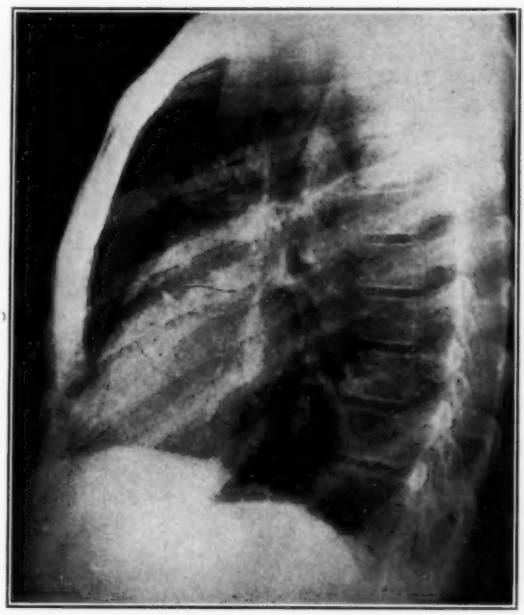


B.

Fig. 4.—Case 2. Roentgenogram made on admission. *A* shows dense streaking to right base obscuring right heart shadow and outline of diaphragm. There is mottling in fourth and fifth left interspace outside heart with obliteration of outline of left diaphragm. Lateral view *B* shows streaking and mottling in retrocardiac space, with blurring of diaphragmatic outline.



A.



B.

Fig. 5.—Case 2. Roentgenograms made five weeks after admission. *A* shows streaking from lower pole of right root to diaphragm and obliteration of right costophrenic angle. In lateral view *B*, the diaphragm is clear, but heavy streaking is still present in retrocardiac space.

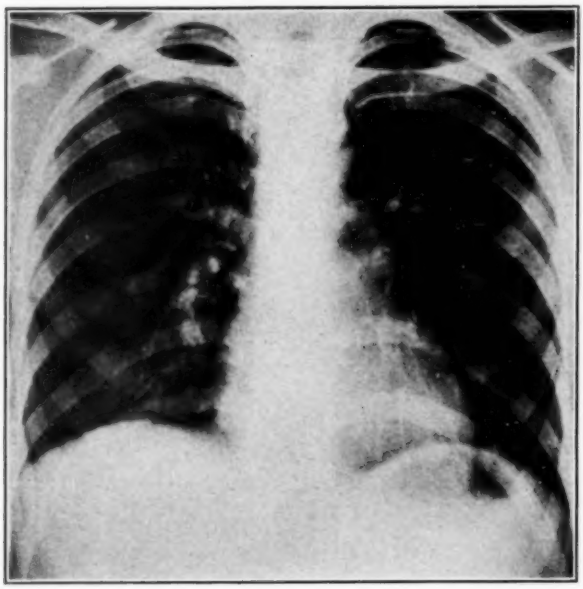
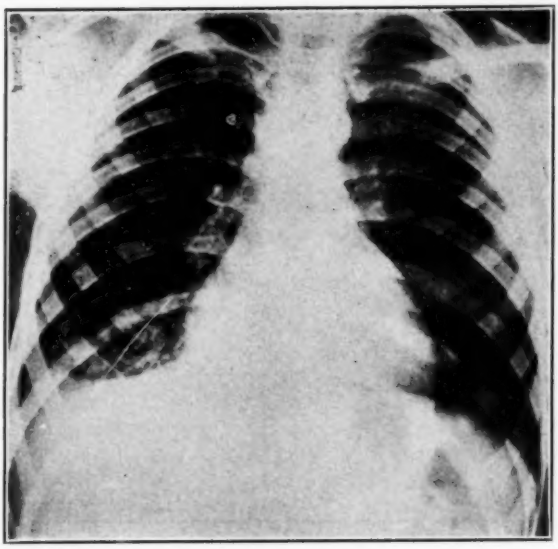


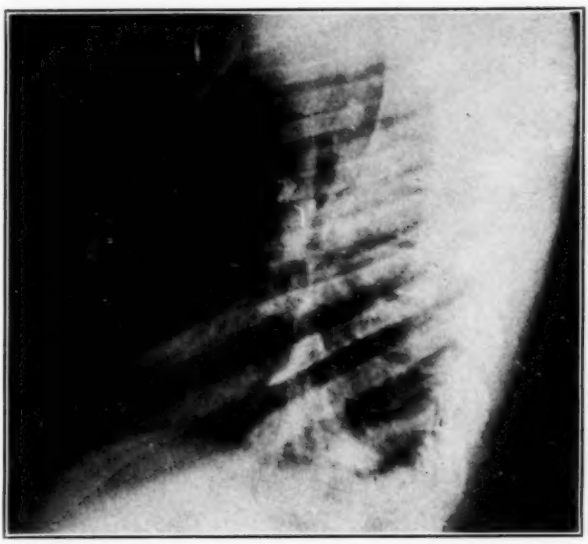
Fig. 6.—Case 2. Negative roentgenogram made eight weeks after admission.

	R.L.	AGE 8 YRS.				ADM. 7-27-34	
HIST.	PERTUSSIS AT 2 YRS. FREQUENT COLDS						
WKS.	2 WKS. AT HOME	3	4	5	6	7	8
	104 103 102 101 100 99 98 97 SLIGHT FEVER						
W.B.C. POLYS		15,350 22,100 65% 69%			11,050 55%		
SYMPTS.	DRY COUGH CHEST PAIN + NASAL DISCHG. +	+ + 0 + +	PROD. COUGH 0 0	+	+	0	
SIGNS		R. BASE DULLNESS DIM. B.S. RESONANT RALES	+ + + +	+ + +	+ 0 OCCASIONAL	0 0	0
		MANTOUX NEG. 1 MG.		SPUTUM CULTURE = STREP. VIRIDANS + STAPH. AUREUS + G.– BACILLI +			
TRTMT.	POSTURAL DRAINAGE		24 C.C. DAILY	16 C.C.	4 C.C.	0	

Chart III.

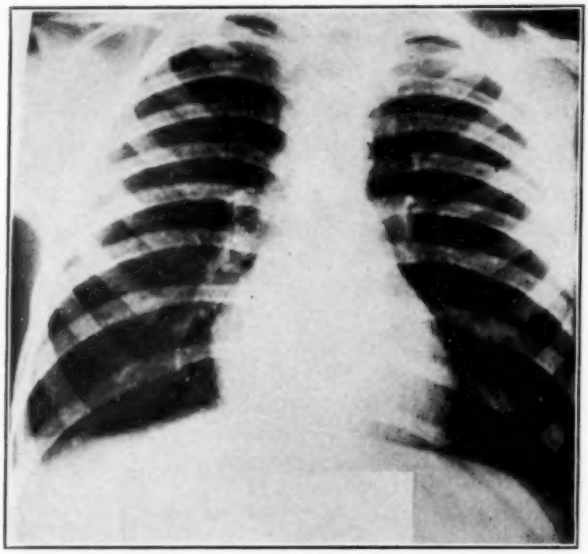


A.

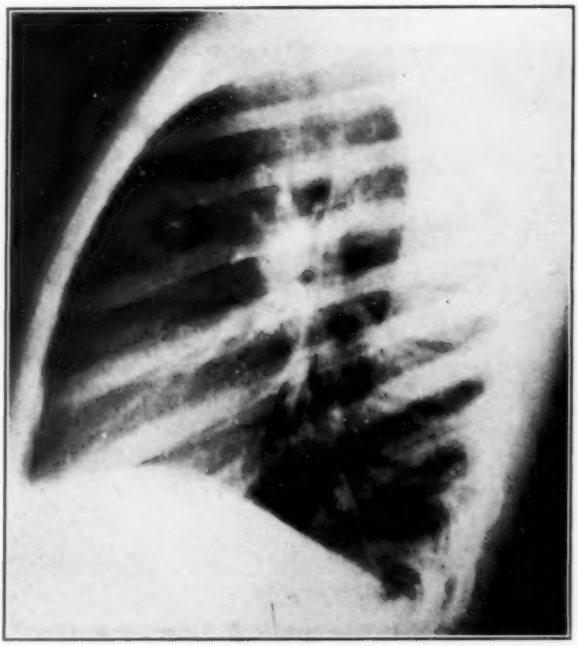


B.

Fig. 7.—Case 3. Roentgenograms made on admission. *A* shows mottling above right diaphragm with obliteration of costophrenic angle. *B* shows the heavy streaking in the retrocardiac space.

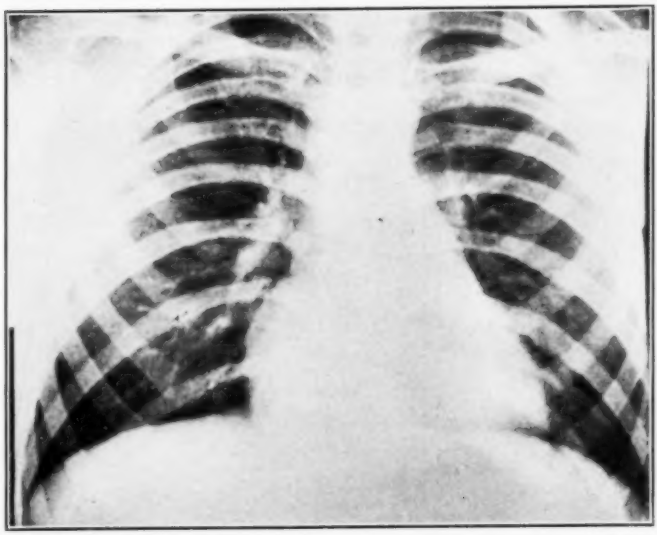


A.

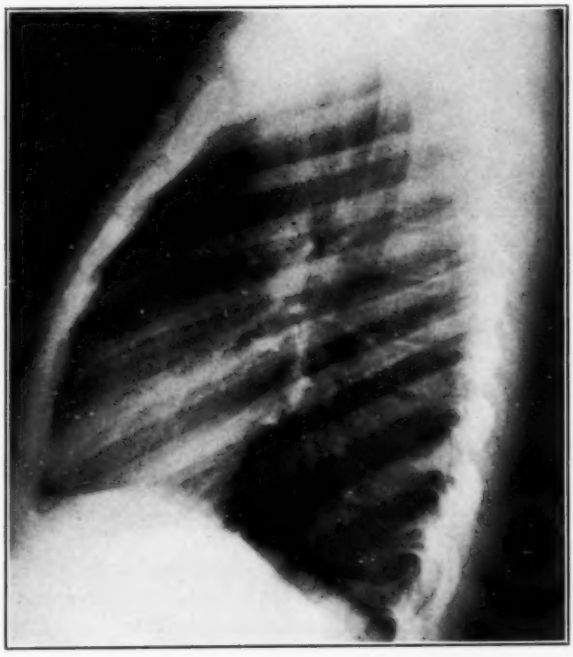


B.

Fig. 8.—Case 3. Roentgenograms made two weeks after admission. *A* shows obliteration of costophrenic angle, and *B*, streaking in retrocardiac space. Note the enlarged node above the bifurcation of the trachea.



A.



B.

Fig. 9.—Case 3. Negative roentgenograms made four weeks after admission, six weeks after onset of illness.

genogram showed marked clearing (Fig. 8), although the physical signs remained practically unchanged. At the end of his fifth hospital week, physical signs and roentgenogram findings were negative (Fig. 9). Bronchogram was normal (Fig. 10).

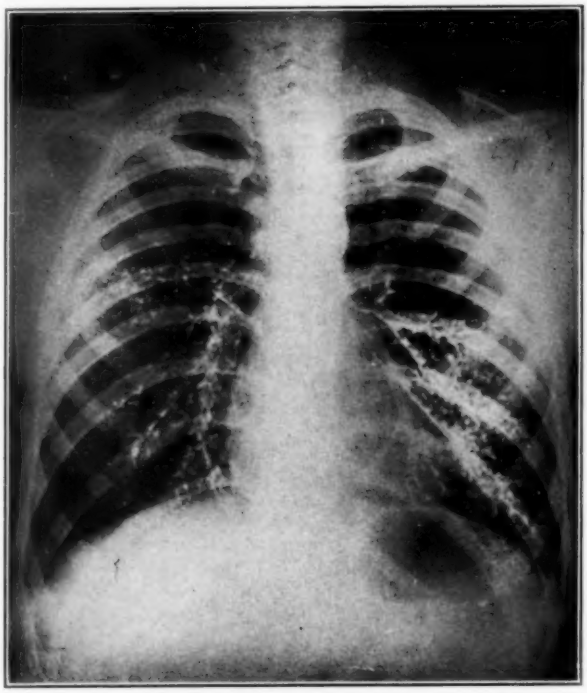


Fig. 10.—Case 3. Normal bronchogram made after abnormal physical signs had entirely disappeared.

COMMENT

It is baffling to see so many cases of a disease whose true nature remains unknown. Speculation as to pathologic lesions is never entirely profitable nor convincing; yet it is not humanly possible to refrain from it. Our chief clue to the pathology is in the roentgenologic shadows. These are irregular, variable in density and extent. At times they show streaks through the uneven density of the rest of the shadow. Many cases show large or small mottled areas in or at the edge of the main shadow.

It may be assumed to some degree, from analogy with autopsies in infants, that the shadows in these cases probably correspond to certain pathologic lesions. We see in autopsies of infants who have died with all forms of pneumonia, the following lesions: intra-alveolar exudates, peribronchial infiltrations with mononuclear cells, interstitial lymphangitis, cellulitis, or fibrosis. (Hemorrhage and abscess, which are also

seen in autopsy in infants, may be omitted from this discussion.) In general, mottled or homogeneous roentgenologic shadows generally corresponded to parenchymal exudate into the alveoli of the lobules. Streaks in the roentgenogram corresponded to peribronchial lesions. In subacute pneumonia we cannot tell whether these are in the wall of the bronchus or in the surrounding connective tissue. If subacute pneumonia is a disease of the connective tissue framework, it must be an acute inflammation, not a fibrosis, since the streaks seen on the roentgenogram ultimately disappear. In infants we have described a pneumonia which shows both peribronchial infiltrations and intra-alveolar exudates to varying degrees, and have suggested the term "broncholobular pneumonia."[6] This is a very fatal form of pneumonia, and we have protocols of fifty autopsies. The roentgenologic shadows of cases of bronchol obular pneumonia are not unlike those of this group of subacute pneumonia, some mottled, some streaked, some with a more homogeneous, but less dense shadow, than that of a pneumococcus lobar pneumonia. Some of us believe that subacute pneumonia may represent in older children a milder and less serious form of bronchol obular pneumonia.

The bizarre bacteriology of all true bronchopneumonias and some animal experiments[7] suggest that a virus may be the real cause. In our cases of subacute pneumonia the bacteriology was also varied and inconstant.

We must repeat that this interpretation is pure conjecture. We believe it is not wise to attach a pathologic name to a disease seen only as a clinical entity. We prefer, therefore, to call these cases subacute pneumonia.

SUMMARY

A subacute form of pneumonia has been described which cannot be classified on a pathologic basis since all our typical cases recovered. It is frequently associated with infections of the upper respiratory tract and has a subacute or prolonged course. Because of its possible tendency to cause permanent damage to the lung, the disease should be treated, even when mild. The upper respiratory infection must not be neglected, and postural drainage of the lung should invariably be used, together with bronchoscopy in severe cases or when collapse of a lobe occurs. Cases which have not cleared completely on roentgenologic examination or by physical signs should have a bronchogram before a diagnosis of bronchiectasis is excluded.

REFERENCES

1. Riesman, D.: Am. J. M. Sc. **144**: 313, 1913.
2. Riesman, D.: J. A. M. A. **102**: 673, 1934.
3. Remé, G.: Monatschr. f. Kinderh. **50**: 297, 1931.
4. Smiley, D. F., Showacre, E. C., Lee, W. F., and Ferris, H. W.: J. A. M. A. **112**: 1901, 1939.
5. Kellner, Frank: Die "Atypische" Pneumonie, Munich, 1936, Otto Gmelin.
6. Smith, C. H., Graef, I., and Andrews, E. T.: Am. J. Dis. Child. **45**: 1141, 1933.
7. McCordock, H. A., and Muckenfuss, R. S.: Am. J. Path. **9**: 221, 1933.

A STUDY OF THE VIRUS FACTOR IN WHOOPING COUGH

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IN SPITE of the accumulation of evidence establishing the Bordet-Gengou organism as the sole etiological agent in whooping cough,[1] the question of the role of a filtrable virus in producing the clinical and pathological picture of this disease has not been finally settled.

No satisfactory answer has been given to the question raised by McCordock[2] and by Rich[3] regarding inclusion bodies found in the lungs in fatal cases of whooping cough. These inclusion bodies were similar to those found in association with virus diseases; consequently, it was thought that a virus might be associated with whooping cough at least in fatal cases. This would classify whooping cough with some other respiratory diseases which have been shown to have a virus association, notably dog distemper,[4] swine influenza,[5] and human epidemic influenza.[6]

The organism of whooping cough, *H. pertussis*, is, in its bacteriologic and clinical manifestations, related to the organism found in human influenza. The pertussis organism is also related to *B. bronchisepticus*. Eldering and Kendrick[7] in fact, have described an intermediate organism, para-pertussis, which resembles both *H. Pertussis* and *B. bronchisepticus*.

Rich and his associates[8] in 1932 inoculated apes with filtered and unfiltered sputum from early human cases of whooping cough. When unfiltered sputum was used, they could reproduce typical whooping cough with positive cough plates. When filtered sputum was used the only effect produced was a febrile upper respiratory catarrh which appeared within a few days and which differed very little from the picture of experimental common cold in apes.

MacDonald and MacDonald[9] reproduced clinical whooping cough by intranasal inoculation of children with cultures of *H. pertussis*. When the cultures were filtered, they failed to produce the disease. They used filtered *H. pertussis* cultures but made no attempt to inoculate children with filtered material taken directly from the respiratory passages of infected children. Because of the difficulties involved in virus culture this seemed a more logical approach to the problem of determining the presence of a virus in the respiratory passages during whooping cough. Accordingly, direct inoculation was done with nasal washings from early proved cases of whooping cough into the nasal passages of children in whom no history of whooping cough or exposure could be obtained.

TECHNIQUE

During an epidemic of whooping cough which occurred in the spring of 1936, several children in the early stages of the disease were selected to furnish material for inoculation experiments. At the same time, 12 children who had no previous history of whooping cough or of exposure were selected for inoculation and were placed in strict isolation in a special unit of the Fresno County Hospital, Contagious Diseases Department.* This season was particularly fortunate in that it minimized the danger of transferring the virus of poliomyelitis which is prevalent chiefly during the late summer.

The nose of the infected child was washed with approximately 50 c.c. of solution. Peptone broth or tyrode medium enriched with chick embryo was used as the washing solution. The washings were allowed to run out from the mouth and nose into a sterile basin and were passed back through the nose two or three times. The washing practically always made the child cough and expectorate so that along with the nasal washing there was considerable coughed-up secretion from the trachea and bronchi. The mucus and purulent material was broken up by shaking in a flask containing a dozen small glass beads.

The washings were then run through a coarse Berkefeld filter. Cultures were made of the washings and the filtrate on Petri dishes of Bordet-Gengou medium enriched with 25 per cent human blood. These were placed in the incubator to be read subsequently. In every case the culture from the washings proved to be positive for *H. pertussis* while the filtrate was sterile. Immediately after filtration, the filtrate was taken to the isolation ward and instillation was begun. Approximately 10 c.c. of the filtrate was instilled, 2 to 4 drops every fifteen minutes, into the nasal passages of one child over a period of about eight hours regardless of whether the child was awake or asleep.

DISCUSSION

In all but four children inoculated there was no noticeable reaction. There was a slight rise of temperature in four cases. In two cases a coryza and cough also developed. In one of these there was a nasal discharge with a cough and rise of temperature which persisted for five days. The other child developed a nasal discharge and more severe cough which lasted for ten days. The details of these cases follow:

CASE 1.—S. J., aged 2 years, was admitted to the hospital March 21. The physical examination was negative; temperature was normal; blood count W.B.C. 5,950, polymorphonuclears 32 per cent, small lymphocytes 64 per cent; large lymphocytes 4 per cent. On March 22 she received filtered washings taken from R. S. who had been coughing for three days and whose cough plate was positive. Two days later the rectal temperature rose to 100° F. and a watery nasal discharge and cough developed. The W.B.C. rose to 7,250. This cough and coryza with slight temperature continued for five days.

*The facilities of the County Hospital were obtained through the courtesy of the director, Dr. H. M. Ginsburg. The bacteriological work was done by Miss Stella Bagdasarian.

CASE 2.—S. C., aged 3 years, was admitted to the hospital on April 4. The physical examination was negative; the temperature was normal; blood count: W.B.C. 6,500, polymorphonuclears, 76 per cent; small lymphocytes, 22 per cent; monocytes 2 per cent. On April 8 nasal instillation was made with filtered washings from B. A. who had been coughing for two days and had a positive cough plate. Forty-eight hours after inoculation, a cold developed with nasal discharge and coughing. There was only a slight rise of temperature and the white blood count showed practically no change. The cough plate was negative. The cough continued until April 18, but there was no whooping or vomiting. Two years later this child was exposed to his brothers and sisters who had whooping cough at home and developed a severe case of whooping cough.

CONCLUSION

Twelve children were given nasal instillations of filtered washings taken directly from the respiratory passages of children with positive cases of whooping cough.

In eight cases no noticeable result followed this procedure. In four cases there was a slight rise of temperature. In two cases coryza and cough developed. The clinical picture presented by these two cases was not unlike the condition known as upper respiratory infection of childhood. In no case did any symptoms resembling whooping cough develop.

REFERENCES

1. Miller, J. J., Jr.: J. A. M. A. **100:** 682, 1933.
2. McCordock, H. A.: Proc. Soc. Exper. Biol. & Med. **29:** 1288, 1932.
3. Rich, A. R.: Bull. Johns Hopkins Hosp. **51:** 346, 1932.
4. Dunkin, G. W., and Laidlaw, P. P.: J. Comp. Path. **39:** 201, 1926.
5. Shope, R.: J. Exper. Med. **54:** 349, 1931.
6. Yamanouchi, T., Sakakami, K., and Iwashima, S.: Lancet, London **1:** 971, 1919. Smith, W., Andrewes, C. H., Laidlaw, P. P.: Lancet **2:** 66, 1933. Dochez, A. R., Mills, K. C., Kneeland, Y., Jr.: Proc. Soc. Exper. Biol. & Med. **30:** 1017, 1933.
7. Eldering, G., Kendrick, P.: J. Bact. **35:** 561, 1938.
8. Rich, A. R., Long, P. H., Brown, J. H., Bliss, E. A., Holt, L. E., Jr.: Science **76:** 330, 1932; Bull. Johns Hopkins Hosp. **58:** 286, 1936.
9. MacDonald, H., and MacDonald, E. J.: J. Inf. Dis. **53:** 328, 1933.

THE PRODUCTION AND USE OF HYPERIMMUNE HUMAN WHOOPING COUGH SERUM

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A PRELIMINARY report on the use of lyophile hyperimmune human serum* in the prevention and treatment of whooping cough was made by McGuinness, Stokes, and Mudd[1] in March, 1937. The present paper describes the method of preparation of this serum and presents an analysis of the cases studied over the three-year period during which the serum has been available.

From studies so far reported, the success of active immunization against whooping cough with vaccine made according to the Sauer technique may make the whooping cough problem one of minor importance in older infants and young children. However, it is probable that very young infants do not respond well to active immunization, and this procedure is rarely carried out before the fifth or sixth month of life. It is obviously important, therefore, to secure some readily available method of passively immunizing these infants, as well as a more specific method of treating whooping cough than exists at the present time, particularly in view of the fact that it is in the younger age group that the disease is so severe, the mortality among infants who contract the disease in the first year of life being 25 per cent or higher.

Bradford[2] in 1935 reviewed the literature on passive immunization against whooping cough with convalescent serum and serum from individuals who had had whooping cough in childhood. Bradford's findings, together with the studies reported by Meader[3] in 1937, indicate that following exposure the injection of convalescent or immune human serums resulted in about 72 per cent of susceptible children escaping the disease, whereas among untreated control groups only 20 to 30 per cent of the exposed children failed to contract the disease.

Because of the great difficulty in obtaining convalescent whooping cough serum in sufficient amounts to be of any practical value, in the spring of 1935 an attempt was made to produce a hyperimmune human serum along the lines suggested by Jundell[4] in 1933. Jundell injected parents, preferably those who had had whooping cough in childhood, with three doses of pertussis vaccine at three-day intervals, and concluded that serum taken from these individuals shortly after the third dose of vaccine was of benefit in the treatment of seven children with whooping cough when administered in the catarrhal stage of the disease.

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*The serum used in these studies was vacuum dried by the lyophile method through the courtesy of Sharp and Dohme, Inc.

In view of the fact that the full response to be derived from a course of Sauer vaccine is not reached until four months after the vaccine injections, it was decided to alter the technique originally described by Jundell by not bleeding the donors until four months after the third or final dose of vaccine. Following the first year of study the technique was again altered in accordance with the fact established in typhoid immunization that once an individual is exposed to an antigen his antibody response will be markedly amplified following subsequent exposures to the same antigen. The technique therefore adopted at that time and still used is as follows: Healthy male adults between the ages of 21 and 30, who had had whooping cough in childhood, were given three courses of Sauer vaccine (Lilly) containing ten billion organisms per cubic centimeter at four-month intervals. Each course of vaccine consisted of three weekly injections of 2 c.c., 3 c.c., and 3 c.c. of vaccine, respectively. Approximately one month following the third course of vaccine, or about thirteen months following the beginning of the initial course, the donors were bled and the serum separated and processed by the lyophile method.[5] The lyophile method has been employed merely to facilitate storage without deterioration, although the ability to concentrate lyophile serums is of distinct advantage when injections are made by the intramuscular route. Most of the donors have been bled at approximately one- to two-month intervals following the initial bleeding and have continued to receive 8 c.c. courses of Sauer vaccine at four- to six-month intervals.

In July, 1936, before the present studies were sufficiently far advanced to permit publication, Kendrick[6] reported on results of passive immunization with the use of a hyperimmune serum produced by giving adults a series of injections of *H. pertussis* in a suspension of ten billion organisms per cubic centimeter, in much the same manner as reported here. She reported that each of the serums studied showed agglutinins for *B. pertussis* and a very strong opsonic reaction. Of 11 infants injected by Kendrick for purposes of passive immunization, 9 failed to develop the disease, one developed a mild pertussis, and one a moderate pertussis.

Katsampes, Bradford and McGuinness[7] have carried out extensive laboratory studies on the lyophile hyperimmune serum prepared in this laboratory, which will be reported in detail in another paper. In one of their studies, in a group of seventeen infants, the majority of whom were under 6 months of age and were in the second or third week of the disease, only three showed the presence of agglutinins, and in these instances the titer was very low. After the intramuscular injection of from 10 c.c. to 40 c.c. of the serum, the agglutinin titer was increased in every instance; in eleven of the seventeen infants the titers ranged from 80 to 640. There was also a marked increase in the phagocytic power of the blood as measured by the opsonocytophagic test. The agglutination titers of the samples of serum tested by Katsampes and

Bradford ranged from 1:1280 to 1:5120. These titers are of interest because they are far in excess of those usually noted in convalescent pertussis and because they approach those obtained when rabbits are immunized with suspensions of *H. pertussis*.

WHOOPING COUGH PROPHYLAXIS—EIGHTY-THREE CASES

Eighty-three children exposed to whooping cough received hyperimmune human serum by intramuscular injection before the onset of catarrhal symptoms. None of these children had ever received any form of active immunization against whooping cough, and none of them had ever had the disease. In this study the original plan was to limit the use of serum to children 3 years of age or younger, exposed continuously to older siblings with definite clinical whooping cough. This was not entirely possible, and therefore the cases have been divided into three groups: those continuously exposed to whooping cough in the same household; those intimately exposed to whooping cough but not in the same household or for long duration; and third, those whose contact with the source of contagion was casual. In this third group were included children exposed on hospital wards in which the cubicle system is employed, brief outdoor and school exposures, etc. Most of these children received two injections of serum from five to seven days apart. The second injections were given because of the relatively long incubation period of whooping cough and the fact that passive immunity may last for 10 to 14 days only. The dose of serum employed varied from 10 c.c. in the average young infants to 20 c.c. in very young infants with close exposure and in the older children. The results obtained in these cases may be seen in Table I. The age distribution of the cases treated and

TABLE I

WHOOPING COUGH PROPHYLAXIS—83 CASES

	NO DISEASE	VERY MILD* DISEASE	MILD† DISEASE	MODERATE DISEASE
Intimate exposure (continuous)	44	5	3	3
Intimate exposure (short duration)	5	5	0	0
Casual exposure (includes ward contacts)	16	1	1	0
Totals	65 or 78.3%	11 or 13.3%	4 or 4.8%	3 or 3.7%

*No whooping or vomiting—mild cough of short duration.
†Whooping but no vomiting—short duration.

the relationship of the age groups to the result obtained may be seen in Chart 1. It will be noted that of the eighty-three children injected, eighteen (21.7 per cent) developed the disease. Of the eighteen cases of whooping cough which developed among the injected children, only seven were accompanied by whooping or vomiting, and it is quite probable that the remaining eleven cases would not have been diagnosed as whooping cough were it not known that they had been in contact with

the disease. These figures are significant in view of the assumption generally regarded as valid, that 70 per cent or more of exposed susceptible children will develop the disease.

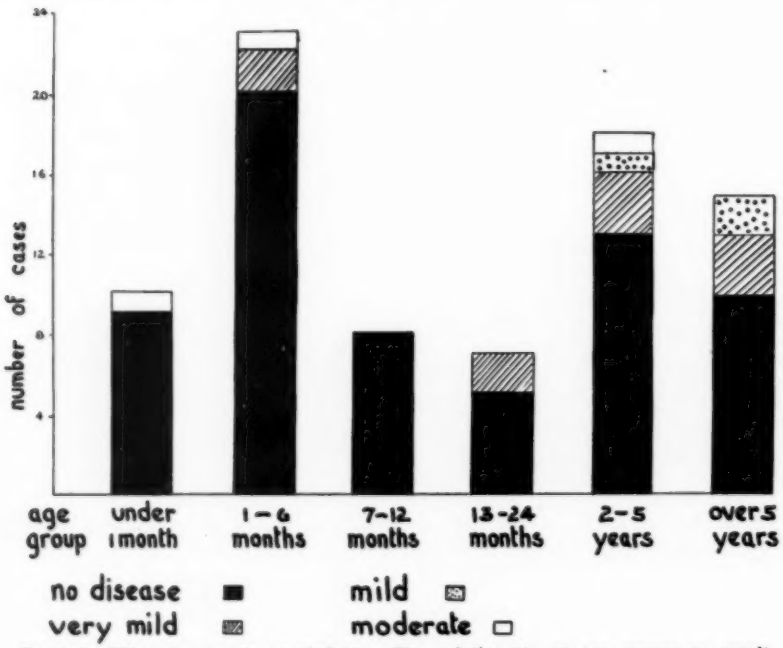

Chart 1.—Whooping cough prophylaxis. The relationship of age groups to result obtained.

One case among those developing whooping cough deserves special comment in view of the fact that it would appear the child was protected for a short time, developing the disease as the passive immunity conferred by the serum began to wane. Baby C., a healthy male infant weighing 8¼ pounds, was delivered at home on Sept. 23, 1938. The mother was refused admission to the hospital because of the fact that her two older children, age 2 and 4 years, had been whooping and vomiting for three days, and because of the fact that the mother herself had developed a paroxysmal hacking cough. The baby was given 20 c.c. of hyperimmune serum twenty-four hours after delivery, and a second 20 c.c. on September 30, at the age of one week. He showed no adverse reaction to the serum and was well and gaining up to the end of the fourth week at which time he weighed 10¼ pounds. On the morning of October 19 the child began to cough and by that evening he had typical severe whooping cough with severe paroxysms of whooping accompanied by cyanosis and vomiting. In the next twenty-four hours the child vomited everything he was fed. Because of his age and the apparent

severity of the disease the child was given 20 c.c. of serum on each of the following days: October 20, October 21, October 22, October 23, and October 27. He showed no adverse reaction to the serum and began to cough and whoop less from the third dose on. Feedings were retained, the temperature was not elevated, and the nights became less restless. During the second week of the disease the baby whooped two or three times during the day and once or twice at night. By the third week the whooping had practically ceased, the baby was eating and gaining well and was apparently well.

WHOOPING COUGH TREATMENT—ONE HUNDRED CASES

One hundred cases of whooping cough have been treated with hyperimmune human serum by intramuscular injection. The majority of these cases were very young children, fifty-one being 6 months of age or younger. There were thirty-four negro children and sixty-six white children. Thirty-four of the cases were treated on hospital wards and the remaining sixty-six in their homes. Forty-five of these sixty-six patients, including thirty of the negro children, were living under the worst housing conditions in South Philadelphia, the majority of these homes being without central heat, and many without inside toilet facilities. In practically all of these cases there were older siblings in the household with whooping cough. There were no deaths among these siblings, but in most instances they were over 3 years of age. The disease in the untreated siblings was invariably much more severe than that in the successfully treated younger infants and children.

The original plan of treatment was to give 20 c.c. of serum every other day until three doses had been given. The general plan of giving three doses was adhered to in most cases, but in some instances only 10 c.c. of serum was given at a dose, and in some cases the serum was given every third or fourth day instead of every other day. From a review of the data it appears that the original plan of giving the serum every other day afforded the best results. A few of the more severely ill children received four and five doses of serum. The total amount of serum usually

TABLE II

WHOOPING COUGH TREATMENT—RESULTS OBTAINED IN 100 CASES

RESULT	NUMBER OF PATIENTS
Excellent	32
Good	31
Moderate	20
Questionable	14
Deaths	3*

*One child died four days following the initial dose of serum, one child died within thirty-six hours following the initial dose of serum, and the third child died within twenty-four hours following the initial dose of serum. All three children had bronchopneumonia.

employed was from 40 to 60 c.c. One patient received 170 c.c.; one, 100 c.c.; and four, 80 to 90 c.c. In three instances a single 10 c.c. dose of serum was given.

The results obtained in this series of cases have been evaluated as (1) excellent, (2) good, (3) moderate, (4) questionable, and (5) deaths. The number of cases falling into each group will be seen in Table II. The age distribution of the children treated and the relationship of the age groups to the result obtained, may be seen in Chart 2. A typical case history from each of the first four groups follows:

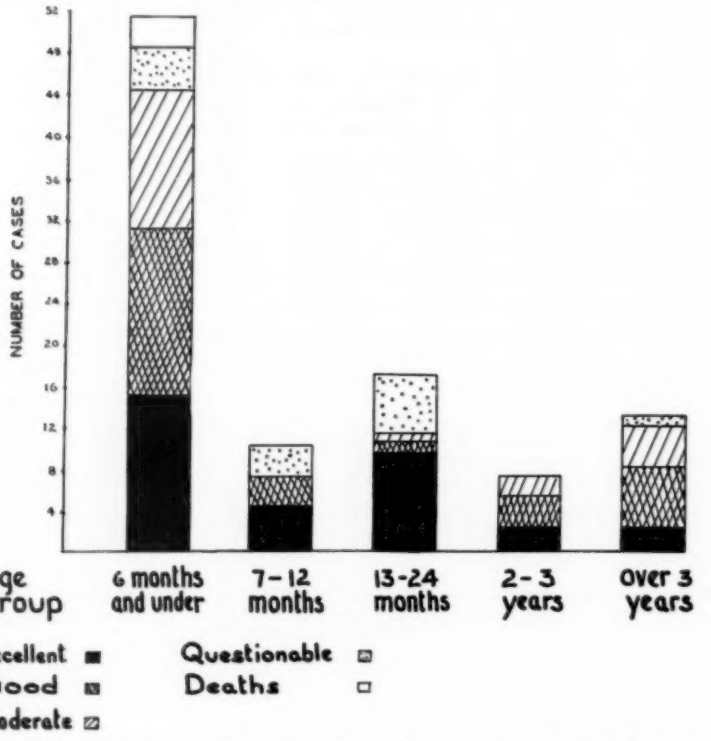

Chart 2.—Whooping cough treatment. The relationship of age groups to result obtained.

GROUP I—EXCELLENT

C. G., a 13-month-old white male, was first seen on Oct. 3, 1938, with a history of cough for one week which had become paroxysmal on October 2. On October 2 he began to vomit and vomited all his meals on that day and on October 3. He was having about 20 paroxysms during the day and about ten bad attacks at night. The temperature was normal. The white blood cell count was 34,000 with 82 per cent lymphocytes. On October 3 the child was given 20 c.c. of hyperimmune serum. On October 6 the child coughed 8 times during the day and 3 times at night; there was little or no whooping. He vomited a mouthful twice in three days. On October 7 he was given a second 20 c.c. dose of serum. In the next twenty-four

hours the child coughed four times and whooped once. His appetite was excellent, and there was no vomiting. From this time on the whooping and vomiting were absent, and the cough was entirely gone by October 15.

GROUP II—GOOD

R. R., a 6-month-old negro male, was first seen on Aug. 15, 1938. At this time he had been whooping and vomiting for about ten days. He was given 20 c.c. of serum on August 15, 20 c.c. on August 19, and 10 c.c. on August 22. On August 19 at the time the second dose of serum was given, there was little if any change. On August 22 when the third dose was given, the whooping and vomiting had entirely disappeared and the child's general condition was excellent. On August 25 the child appeared well and only had an occasional "hack."

GROUP III—MODERATE*

L. I., a 6-month-old negro male, was first seen on Aug. 1, 1938. The child at this time had been coughing frequently and hard for four or five days, and was vomiting almost all food and fluids ingested. The white blood count was 24,000 with 70 per cent lymphocytes. On August 1, 20 c.c. of serum was given; on August 4, 10 c.c.; on August 8, 20 c.c.; and on August 17, 10 c.c. On August 4 the child was still coughing very hard and vomiting nearly all his food. The disease continued to be severe until after the fourth dose of serum on August 17. By August 19 the vomiting had stopped and the cough was much less severe. On August 25 it was reported that the child no longer coughed at night and only hacked once or twice during the day.

GROUP IV—QUESTIONABLE

J. S., a 2-year-old negro male, was first seen on Aug. 15, 1938. He had been coughing for ten days, and whooping and vomiting for four days. He was given 15 c.c. of serum on Aug. 15, 20 c.c. on August 19, 20 c.c. on August 22, and 10 c.c. on August 29. Visits on August 19, August 22, August 29, and September 7 found the child continuing to have very severe paroxysms and still vomiting at practically every meal. On Sept. 15, 1938, the child was not vomiting as much, and the cough was less frequent but still severe. From this time on improvement slowly continued, and the child eventually recovered.

There were three relapses among the one hundred treated cases. These relapses suggest, as did the case described in the prophylaxis group, that symptoms were retarded only for such time as the antibodies conferred by the serum remained in fairly high concentration. An illustrative case follows:

C. G., a 5-month-old white female, was first seen on March 20, 1939. She had been coughing for two weeks, and for one week had been having attacks about every half hour, frequently accompanied by severe cyanosis. She was given 20 c.c. of serum on each of the following days: March 20, March 23, and March 25. On March 25 the mother reported that the baby had had only three attacks of coughing in the previous twenty-four hours, and that the attacks were no longer accompanied by cyanosis. On April 4, ten days following the last injection of serum, the baby began to cough again, vomit, and on April 5 appeared to have severe

*Included in this group is a series of eight cases of whooping cough with bronchopneumonia, all 6 months of age, or under, who were treated by Dr. Horace L. Hodes of Baltimore. While it is difficult to evaluate the effect of serum in these cases, the fact that they all recovered is of significance.

whooping cough again. She was given an additional 20 c.c. dose of serum on April 5, and from April 6 on had only two or three attacks of coughing a day, no coughing at night, and no further vomiting.

There were three deaths among the one hundred children in the treated group. Those who died were all white infants of two months of age, and all had bronchopneumonia at the time treatment was first instituted. One infant was given 20 c.c. of serum forty-eight hours before death and a second dose of 20 c.c. twenty-four hours before death. A second infant was given 20 c.c. of serum thirty-six hours before death and a second dose of 20 c.c. twelve hours before death. The third infant received a single dose of 10 c.c. of serum twenty-four hours before death. In view of these facts, it would be difficult to classify them as failures in treatment with the possible exception of the first case. It is significant that these were the only deaths among fifty-one infants of 6 months of age or under treated with hyperimmune serum, when the expected mortality rate in this age group is 25 per cent or over.

The best results from the use of hyperimmune serum were obtained when therapy was begun in the first two weeks of the disease, and generally speaking the earlier the serum therapy was instituted, the better were the results. A number of the cases showing only fair or questionable results were in the older age group, whereas the best results were obtained in infants. Obviously, the amounts of serum given to infants were proportionately far larger, and for this reason may have been more effective.

COMMENT

From the results described above it would appear that hyperimmune human serum prepared according to the technique outlined is a valuable adjunct in the prophylaxis and treatment of whooping cough. It is unfortunate that more accurate records of the exact number of attacks of whooping and vomiting could not be kept on the treated cases. It was practically impossible to do this in the type of home in which most of these cases were followed. It is felt, however, that the reports obtained by the physicians and nurses following the cases have given a fairly accurate account of the progress of the disease in the cases studied since they were visited at least every third or fourth day during the active stages of the disease.

Studies to determine the rate of antibody response in the course of immunization of the donors are in progress. It is hoped that as a result of these studies more accurate data may be obtained as to the optimal dosage of vaccine, the optimal interval between vaccine injections, and the optimal time following vaccine injections to withdraw blood for serum.

It is probable that intravenous administration of serum may be more effective than intramuscular injections in the more seriously ill patients. This problem is also to be studied as further cases become available.

It would seem important to stress the fact that while it is important in facilitating the storage and concentration of pertussis hyperimmune serum, the lyophile process is not an absolutely necessary feature of the preparation of hyperimmune serum as described in this paper. It is quite feasible to immunize donors in small communities where serum exchange facilities are not available, and to use whole blood injections where facilities for separation of serum are likewise not available.

SUMMARY AND CONCLUSIONS

1. A method is described for the preparation of a "hyperimmune" human whooping cough serum by injecting donors with repeated doses of vaccine prepared according to the technique originally described by Sauer.

2. Sixty-five, or 78.3 per cent, of eighty-three susceptible contacts injected with hyperimmune serum following exposure failed to develop whooping cough. In eleven of the eighteen cases developing whooping cough the disease was markedly attenuated.

3. One hundred infants and children, fifty-one of whom were 6 months of age or under, were treated with hyperimmune serum. Excellent results were obtained in thirty-two cases, good results in thirty-one cases, moderate results in twenty cases, and questionable results in fourteen cases. There were three deaths among the hundred treated cases.

4. It is probable that injections of whole blood from donors immunized as described would be of value in communities where facilities for separation of serum are not available.

REFERENCES

1. McGuinness, A. C., Stokes, J., Jr., and Mudd, S.: J. Clin. Investigation **16**: 193, 1937.
2. Bradford, W. L.: Am. J. Dis. Child. **50**: 918, 1935.
3. Meader, F. M.: Am. J. Dis. Child. **53**: 760, 1937.
4. Jundell, I.: Acta paediat. **16**: 400, 1933.
5. Flosdorf, E. W., and Mudd, S.: J. Immunol. **29**: 389, 1935.
6. Kendrick, Pearl: J. PEDIAT. **9**: 117, 1938.
7. Katsampes, C. P., Bradford, W. L., and McGuinness, A. C.: The Effect of Hyperimmune Serum (Lyophile) Upon the Humoral Antibodies in Pertussis, Am. J. Dis. Child. (In press.)

A COMPARATIVE STUDY OF THERAPEUTIC AGENTS IN THE TREATMENT OF PERTUSSIS

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IN THE course of investigations on the prevention of whooping cough previously reported[1] more than 1,000 cases of pertussis have been treated in the Whooping Cough Clinic of the Bronx Hospital during the past four years. A study was undertaken in order to judge the efficacy of several specific and nonspecific methods of treatment recommended for the therapy of the disease.

The general measures advocated in all children included fresh air, careful feeding of several small meals instead of three meals per day, and treatment of complications. In addition, in separate groups of patients different local measures or medication were employed. These comprised gold tribromide, 3 per cent ephedrine by mouth and nasal passages, 1 per cent adrenalin sprayed into the larynx, and large doses of paregoric, as well as the usual antipyrine-bromide-belladonna mixture. None seemed to give any genuine relief, which is the common experience reported in the literature.

In other groups of children the question was studied whether any of the following immunologic treatments would modify the course of the disease:

1. Injections of a typhoid-paratyphoid vaccine
2. Injections of Sauer's vaccine
3. Injections of Board of Health "toxin vaccine"
4. Injections of a pertussis vaccine prepared by Bordet
5. Injections of topagen* soluble
6. Nasal instillations of topagen*
7. Injections of convalescent serum
8. Injections of "hyperimmune serum"

In addition, a control group was given injections of saline. This group consisted of 80 children. They received 1 c.c. of physiologic saline every two days. The treatments in the eight other groups were as follows:

1. Forty children were given subcutaneous injections of typhoid-paratyphoid vaccine prepared by the New York City Board of Health. The doses—0.25 c.c. to 2 c.c.—were large enough to produce febrile reactions. The injections were given at daily and in some cases at two-day intervals.

From the Whooping Cough Clinic of The Bronx Hospital.

*These preparations were kindly furnished by Mulford Biological Laboratories and Sharp & Dohme, Inc.

2. Ninety children received 10 billion organisms of *H. pertussis* in Sauer's vaccine daily for 5 to 7 days.

3. Forty children were given daily injections for 5 to 7 days of a specially prepared "toxin vaccine" furnished by Mishulow of the New York City Department of Health Laboratories. This vaccine contained 10 billion organisms per cubic centimeter.

4. Seventy-two hospital cases were treated with 4 to 6 injections of a bacterial vaccine containing *H. pertussis,* which was prepared by Bordet. All children were in the paroxysmal stage of whooping cough. The results of this treatment have been published previously.[2]

5. Forty children received subcutaneous injections of topagen soluble. This product which is essentially the soluble protein of *H. pertussis* in physiologic saline[3, 4] was supplied to us in two forms: nasal topagen and topagen for hypodermic injections. We gave from three to five injections of this product at intervals of two to three days. The dosage was 1 c.c. for each dose.

6. Seventy-two children were given daily nasal instillations of topagen. The patients received 10 drops into each nostril every day or other day for a total of five to ten doses.

7. Thirty-six children received convalescent serum in dosages of from 5 to 40 c.c. intramuscularly. The blood was collected from patients in the eighth to the tenth week of the disease. The blood was centrifuged, the serum separated, a Wassermann test and sterility tests were done. After the addition of a preservative it was stored in the icebox.

8. Twelve children were injected with 5 to 40 c.c. of "hyperimmune serum." This was prepared from donors who had been injected with Sauer's vaccine in doses from 170 to 200 billion organisms over a period of six weeks. Two weeks after the last injection the blood was taken and the serum prepared in the same way as outlined above.

The age distribution of the serum-treated patients was from four weeks to four years, with about 50 per cent falling in the first year of life.

In private practice we have observed no beneficial results with the use of Krueger's vaccine in the treatment of whooping cough. Nevertheless, we decided to test this observation as compared with our control cases. In so treating a smaller number of cases (15), we saw results not different from those obtained with the other forms of vaccine therapy previously studied.

METHOD OF STATISTICAL ANALYSIS

It is obvious that due to the variations in the course of the natural disease it is very difficult to judge modifications in an individual case treated with any therapeutic measure. We, therefore, in order to obtain comparable results, employed the method used by Kerley,[5] Bamberger and Menke,[6] and Miller and Singer-Brooks.[7] The number of paroxysms

occurring in twenty-four-hour periods was charted and a curve of the average frequency of paroxysms during the course of the disease was constructed for each of the various therapeutic agents.

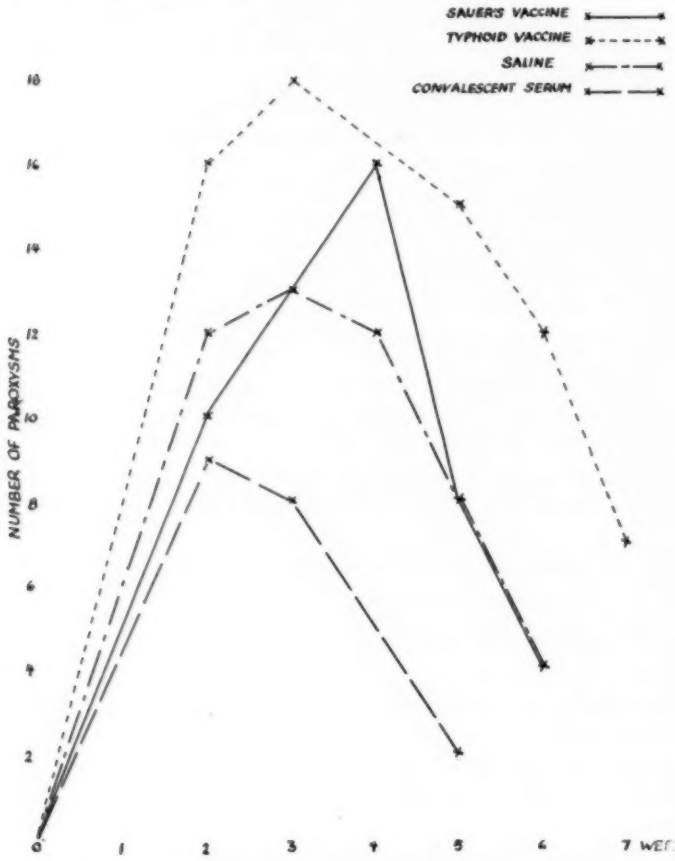

Chart 1.—Efficacy of different therapeutic agents as compared with saline (control) on paroxysms in whooping cough cases.

The results obtained on employing this method are given in Charts 1 and 2. The curves represent the average number of coughs in twenty-four hours plotted against weeks of the disease. We have judged the start of the illness from the first day of cough, rather than weeks of the spasmodic stage, inasmuch as this method gives us a stable base point for comparison. The objection to using the paroxysmal stage only is that some children never whoop in spite of definite seizures, and the onset of the paroxysmal stage is by no means fixed. Thus, we have seen children with paroxysms after 4 days of coughing, and others who have coughed for 20 days before paroxysms.

These curves show that the number of coughs in cases treated with convalescent and "hyperimmune" serum is definitely less than the controls. On the other hand, the number of coughs in cases treated by topagen showed no appreciable difference from the control group. Pertussis vaccines seemed actually to aggravate the symptoms, both in number of coughs and duration of the disease. The duration of the disease was somewhat shortened by the sera. The peak of frequency in every instance was reached between the third and fourth week of the disease.

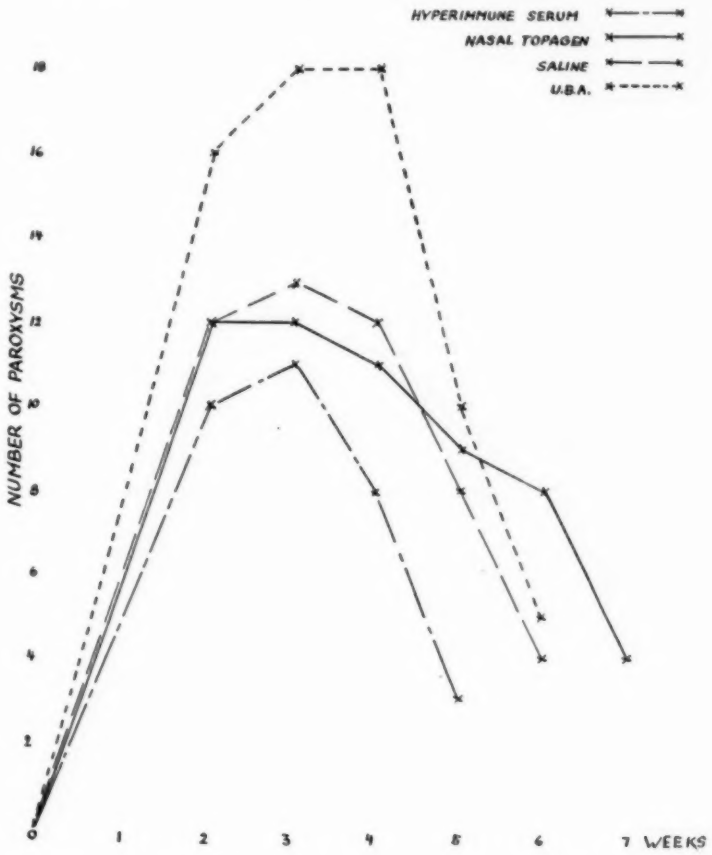

Chart 2.—Efficacy of different therapeutic agents as compared with saline (control) on paroxysms in whooping cough cases.

We are aware that this method of assaying the disease is not complete. We have, therefore, further analyzed the intensity of the paroxysms, the number of vomiting spells, the nutrition, the general condition of the patient, and the presence of complications. This method is shown in Table I, in which the results are classified as excellent, i.e., abortive case;

good, i.e., mild case; fair, i.e., moderate case; and poor, i.e., severe case. The division into these four groups was made according to the following general scheme: abortive—2 to 4 paroxysms per day, no whoop, vomiting, or cyanosis; mild—6 to 8 paroxysms per day, occasionally whoop or vomiting but no cyanosis; moderate—8 to 16 paroxysms per day, whoop and vomiting, but no cyanosis; and severe—16 to 30 paroxysms a day, whoop, vomiting and cyanosis or other complications. This method of judging at least has the virtue of being objective, which is an absolute necessity in the evaluation of treatment of a disease so variable as whooping cough.

The cases treated with vaccine therapy, typhoid-paratyphoid, Sauer's vaccine, "toxin" vaccine, and U.B.A. seemed worse than the controls. The cases treated with topagen, both by the nasal and the subcutaneous routes, yielded disappointing results. On the other hand, the children treated with convalescent and hyperimmune serum showed distinctly better results. It must be recalled that the serum-treated group contained our youngest children, the infants, and hence apparently the most severe cases. There were isolated cases with striking results. Thus, one 3-month-old child in the third week of cough, with severe whoop and cyanosis, was given 20 c.c. of convalescent serum with cessation of whoop within forty-eight hours. In another case, a physician coughing violently for four days, ten days after exposure to pertussis, was given 40 c.c. of convalescent serum with cessation of cough in forty-eight hours. It is worth mentioning that in our series of 48 serum-treated cases, the majority in infants and severe, there were no pulmonary or other complications.

TABLE I

RESULTS OF TREATMENT

	CONTROL SALINE	TYPHOID VACCINE	SAUER'S VACCINE	TOXIN VACCINE	BORDET VACCINE	TOPAGEN		CONVALESCENT SERUM	HYPERIMMUNE SERUM
						NASALLY	HYPODERM.		
Number of cases	80	40	90	40	72	72	40	36	12
Abortive cases	6.2%	5%	5.5%	7.5%	0%	8.3%	0%	22.2%	25%
Mild cases	12.5%	5%	16.7%	10 %	0%	25 %	20%	66.6%	50%
Moderate cases	56.3%	60%	44.4%	50 %	36.3%	41.7%	70%	11.1%	25%
Severe cases	25 %	30%	33.4%	32.5%	63.6%	25 %	10%	0 %	0%
Complications									
Pneumonia	2	1	3	1	6	1	0	0	0
Convulsions	1	0	1	0	1	0	0	0	0

Table I shows that the worst results were obtained with the vaccine prepared by Bordet which shows no excellent or good cases. However, these were children in a hospital ward hospitalized because of severe

cases and often with a pulmonary complication on entrance. It is a question whether any therapy would help these patients.

In the treatment of whooping cough the value of convalescent serum and of serum of adults treated previously with pertussis vaccine is still doubtful. An excellent survey of the literature regarding this subject may be found in Bradford's article on convalescent blood in whooping cough. A majority of workers found convalescent serum highly effective in the prophylaxis of directly exposed infants and older children.[9, 10, 11] The dosage reported varies very much in different publications, as does the mode of administration. From Bradford's review it is apparent that the success of serum and hyperimmune serum in the treatment of pertussis is doubtful. This is an opinion which is corroborated by Kendrick.[12] We believe that early administration in large doses, particularly when injected *before the paroxysmal* stage of the disease, has in some cases a beneficial effect and at times a striking effect. It is worth while using in severe cases.

SUMMARY

1. More than 1,000 cases of whooping cough have been treated, of which 432 could be carefully followed through the disease; 80 patients served as controls.

2. Curves of average frequency of coughing spells in twenty-four-hour periods, as well as careful division of cases into "excellent," "good," "fair," and "poor" results of treatment, have been used to determine the efficacy of treatment.

3. Vaccine therapy, whether with Krueger's vaccine, Sauer's vaccine, toxin vaccine, or Bordet vaccine, not only did not ameliorate the symptoms but actually produced curves above those of the control cases.

4. Results obtained with nasal topagen and with soluble topagen hypodermically did not differ materially from the untreated controls.

5. Cases treated with convalescent serum and with hyperimmune serum showed fewer coughing spells, a shorter period of illness, and greater freedom of complications. These results could only be obtained when the serum was injected before the paroxysmal stage of the disease.

REFERENCES

1. Cohen, Ph., Lapin, Jos. H., and Weichsel, Manfred: In print.
2. Weichsel, M.: Monatschr. f. Kinderh. **52:** 106, 1932.
   Weichsel, M., and Schmidt, H.: Monatschr. f. Kinderh. **53:** 373, 1932.
3. Slesinger, A. A.: Pennsylvania M. J. **61:** 485, 1938.
4. Gold, H.: J. PEDIAT. **10:** 641, 1937.
5. Kerley, C. G.: Treatment of Diseases of Children, Philadelphia, 1907, W. B. Saunders Co., p. 321.
6. Bamberger, P., and Menke, H.: Klin. Wchnschr. **14:** 1036, 1935.
7. Miller, J. J., and Singer-Brooks, Charlotte: Am. J. Dis. Child. **53:** 720, 1937.
8. Bradford, W. L.: Am. J. Dis. Child. **50:** 918, 1935.
9. Jundell, I.: Acta pediat. Scandinav. **15:** 1, 1933.
10. Bradford, W. L.: J. PEDIAT. **9:** 117, 1936.
11. Meader, F. M.: Am. J. Dis. Child. **53:** 760, 1937.
12. Kendrick, Pearl: Round table conference, J. PEDIAT. **9:** 118, 1936.

1175 PARK AVENUE

THE SYNDROME OF HYDROMICROCEPHALY

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THE prefixes in the main word of the title may appear contradictory because hydrocephalus in its ordinarily accepted meaning creates a mental picture of a head larger than normal, out of proportion in the upper part, and microcephaly conveys quite the opposite picture. If hydrocephalus, however, is construed to mean only a dilatation of the ventricles of the brain, regardless of the size of the brain or the head, the apparent contradiction can be easily reconciled.

In the term hydromicrocephaly, the order of the prefixes is significant; it has been chosen to emphasize the microcephaly which, from the clinical viewpoint, is conspicuous.

Briefly, then, hydromicrocephaly is seen in infants with small heads that house small brains containing ventricles much larger than normal.

The preliminary pneumographic studies which form the groundwork for the present series were made by Gerstenberger and his associates at the Babies and Childrens Hospital of Cleveland in 1927. Work on the present series of cases admitted to the public and private services of the same hospital, for neurologic study, was begun in 1933. The first case of hydromicrocephaly in this series was encountered in 1935. Encephalography was indicated for a better understanding of the diseases presented by 142 infants and children. In a few of these cases two or more encephalographic studies were made.

Thirteen cases proved to be typical hydromicrocephaly. While this diagnosis may often be suspected from the clinical history and the physical findings, the true conditions within the cranial cavity will be revealed unequivocally only by encephalography or necropsy.

No large series of cases of hydromicrocephaly has been reported in the literature up to the present time. Nor has any serious effort been made to correlate the objective findings with a definite clinical syndrome. Both of these tasks I shall attempt, briefly, in this report.

REVIEW OF LITERATURE

The term hydromicrocephaly is not original with the writer. Although it is not listed in the *Quarterly Cumulative Index Medicus* or in the *Index-Catalogue* of the Library of the Surgeon-General's Office, it is recognized by the *Standard Classified Nomenclature of Disease*[1] under diseases of the brain, code 901-0191.

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An incomplete review of the literature reveals that the term seems to have been first proposed by Cruveilhier[2] in 1856 and was subsequently accepted by Zappert,[3] Ballantyne,[4] von Bókay[5] and von Reuss.[6]

Cruveilhier's 1856 description of this condition was as follows:

> There are several kinds of congenital ventricular hydrocephalus depending (1) on the quantity of fluid, which is in proportion to the size of the skull, and (2) on the condition of the brain.
>
> Under the former, the size of the skull may be larger than normal, normal, or smaller than normal.
>
> The condition of the brain also varies. There may be ventricular hydrocephalus with the brain intact except for some atrophy. On the other hand, the brain may be completely destroyed to the point of anencephaly. The anencephaly may involve the cortex above the ventricles while the base of the brain remains normal, or both cortex and base may be involved. In this event the cerebellum usually is spared, but it too may be entirely destroyed. It is very remarkable that particularly in the hydrocephalus with a small head (hydromicrocephaly) one encounters the most extensive destruction of the brain. Thus in two stillborn microcephalic infants whom I saw at the Maternité, the skull in each was filled with fluid so that there remained neither cerebrum, cerebellum nor pons, but only a hard, shapeless nodule at the base.

Later, in 1862, Cruveilhier[7] referred to these cases again and added:

> It is remarkable that the changes in the cerebral tissues in hydrocephalus are not in any way related to the quantity of fluid present. One could even say that sometimes there is an inverse ratio; for in the cases which I have collected, it is the hydrocephalies with the small heads (micro-hydrocéphales) which have shown the most marked anencephaly. Such is the following case: Hydro-anencephaly in a microcephalic fetus. In a stillborn infant whose skull was not half the normal size, I found in place of the brain a sac filled with clear serum. In the part which lined the vault, this sac was formed by a vascular membrane, with brownish orange spots as in certain apoplectic areas. A dense brown membrane covered the remaining base of the brain. The base had been reduced to (1) corpora striata, hard, brownish and unequal in size, (2) atrophied optic thalami which could scarcely be made out between the striate bodies, (3) a few hard cartilaginous cerebral convolutions on the inner surface of the pia and arachnoid. The olfactory nerves were atrophied. Traces of the anterior pyramids were seen as a grayish streak sunk in the body of the medulla. The olives and the corpora quadrigemina were of normal size. The cerebellum was small but not abnormal, as were also the pons and the cerebral peduncles.

The cases of hydromierocephaly encountered by the writers since Cruveilhier's time, to whom I have referred, were all described before the introduction of encephalography by Dandy.

Zappert[3] wrote:

> Hydromicrocephalus or hydranencephalus (Cruveilhier) is the term used to designate a rare malformation in which the external skull is

> diminished in size instead of enlarged, and the brain itself is represented by a watery cyst. The condition is apparently due to the collection of hydrocephalic fluid at a time when the cerebral cortex is still in the initial stages of its development. The medulla oblongata and small portions of the basal ganglia may in such cases represent the sole remains of the brain.

In a case described by Zappert and Hitschmann,[3] although the child lived for eleven days, deficiency of the brain had not been suspected.

Ballantyne,[4] writing on microcephaly in 1904, said:

> There may be various degrees of dropsical distention of the ventricles or hydrocephalus (the only specimen of microcephaly which I have examined was an instance of hydro-microcephaly); . . .

Von Bókay[5] in 1913 reported a case of hydromicrocephaly in which a diagnosis was made by transillumination of the brain. This ante-mortem diagnosis was confirmed by post-mortem examination, and it seems to be the only ante-mortem diagnosis made before the introduction of encephalography. More recently, with the aid of encephalography, reports have been made of other cases in the living.

Von Reuss[6] stated in 1921 that in congenital hydrocephalus "the external circumference of the skull is not necessarily enlarged, indeed it may be abnormally small and present the characteristic shape of microcephaly. In such cases, the whole brain is converted into a watery cyst . . . . and the condition is termed Hydromicrocephaly. . . ."

Crothers, Vogt, and Eley[8] reproduced encephalograms with "reasonably symmetrical dilatation of ventricles," and stated: "In general, we regard the dilatation as due to a deficit of brain tissue rather than as hydrocephalus from obstruction or lack of balance between formation and absorption of fluid."

Kruse[9] described two cases of microcephaly with internal hydrocephalus occultus.

Walker[10] reported a case of spastic quadriplegia in a child 3 years of age whose head circumference measured only 40 cm. Encephalograms made of this patient showed a marked internal hydrocephalus and cortical aplasia.

Brody and McAlenney,[11] in a study of 100 encephalograms made of children with convulsions in order to determine those children who might be helped by operation, encountered eight cases of microcephalic idiocy. In four of these patients were found "symmetrically enlarged ventricles and absent cortical air markings, and we consider these findings suggestive of cerebral maldevelopment." One of these four cases is reported in detail.

Mention of *microhydro*cephaly is made by Rupilius.[12] Stankiewicz and Vincenz[13] observed three patients with microcephaly, in two of whom occult hydrocephalus was demonstrated by encephalography.

In the report on encephalography by members of the staff of the Royal Aberdeen Hospital,[14] encephalograms are reproduced of a microcephalic idiot, aged 2½ years, whose head measured only 42.5 cm. (17 inches) in circumference. The films showed a communicating hydrocephalus with marked dilatation of the ventricles and the basal cisterns.

In Crothers' chapter on the nervous system in Brennemann's *Practice of Pediatrics*[15] are shown encephalograms with the following legends: "Prenatal anomaly with very little brain substance. Hydrocephalus *ex vacuo*. Practically anencephalus"; and "Prenatal condition. Small head, rounded large ventricles. Microcephalus."

The foregoing references to reports made in the literature suffice to demonstrate that the condition of hydromicrocephaly has been rather widely recognized during the past century as a pathologic but not as a clinical entity, although no unanimity of opinion prevails with regard to its etiology or age incidence. Most of the writers mentioned seem to favor the theory of a prenatal defect of undetermined etiology.

CASE REPORTS

Certain important data can be gleaned from the records of the clinical history and physical examination of the thirteen cases studied at the Babies and Childrens Hospital.

In the clinical history, information was sought especially with regard to the following points:

1. Prematurity.
2. Character and duration of labor.
3. Birth injury or symptoms suggestive of cerebral anoxia.
4. Convulsions during the neonatal period or later.
5. Acute infections, especially those which might indicate involvement of the central nervous system.
6. Time of closure of the anterior fontanel.
7. History of later trauma.
8. Acuity of vision.
9. General physical development.
10. Mental development.

In the physical and neurological examination, specific information was sought as follows:

1. Anthropometry:
   - Circumference of head.
   - Circumference of chest.
   - Body weight.
2. Condition of the anterior fontanel and size, if still open; overlapping of sutures.
3. Appearance of optic nerve head in the retina.
4. Evidence of disease of crossed pyramidal tracts.
5. Psychometry.

TABLE I

DATA FROM CLINICAL HISTORIES

CASE	AGE ON ADMISSION (MO.)	SEX	ADMISSION COMPLAINT	BIRTH WEIGHT (GM.)	LABOR	CONVULSIONS	ACUTE INFECTIONS	SIZE OF ANTERIOR FONTANEL	VISION	MENTAL STATUS
1	7¾	F	Blindness	2500	No instruments	None	None	Barely 1 fingertip	Poor	Retarded
2	10	M	Convulsions	3175	Easy	Began at 4 mo.	None	½ fingertip	Blind	------
3	5	F	Possible birth injury	3400	24½ hr.	Shortly after birth	None	--------	Normal	Retarded
4	4	M	Microcephaly	----	Normal	At 2 mo.	None	Closed at 3½ mo.	Poor	Retarded
5	31½	M	Spastic paralysis	2950	Normal	None	Pertussis at 10 mo.	Closed at birth	Congenital cataracts	Retarded
6	9½	M	Convulsions	3710	Easy	Began at 8 mo.	None	Small at 5 mo.; ½ fingertip	Poor	------
7	36	M	Idiocy	----	--------	None	------	--------	----	Retarded
8	4	F	Vomiting	3520	Easy	None	None	Closed at 4 mo. Sutures overlap	Poor	Retarded
9	8¾	F	Poor vision	3700	Normal	None	None	--------	Poor	Retarded
10	5½	F	Nervousness	2780	Easy	None	Pneumonia at 11 wk.	Very small; 1 fingertip	----	Retarded
11	11	F	Small head	2880	Difficult	Began at 10 mo.	None	Closed at 7 mo.	Normal	------
12	8	F	Birth trauma	----	Difficult	None	None	Closed	Poor	Idiot
13	5	M	Nervousness	2560	Easy	None	None	2 fingers	Normal	Retarded

The laboratory study included determination of:

1. Serologic reactions in blood and spinal fluid.
2. Spinal fluid pressure.
3. Routine examination of spinal fluid for macroscopic appearance, globulin, cell number, and differential count.
4. Condition of the cranial cavity by encephalography through lumbar or cisternal routes.

In order to record each of these thirteen cases and yet avoid monotonous repetition of closely similar stories, only four case reports are given in detail. The data concerning clinical histories, physical and neurological examinations, laboratory findings, and results of encephalography in all thirteen cases are summarized in Tables I to III.

TABLE II

DATA FROM PHYSICAL AND NEUROLOGICAL EXAMINATIONS ON ADMISSION

CASE	AGE (MO.)	HEAD CIRCUMFERENCE (CM.)	CHEST CIRCUMFERENCE (CM.)	WEIGHT (GM.)	OPTIC NERVES	SPASTICITY	HYPERACTIVE REFLEXES	PSYCHOMETRY
1 (1st)	7¾	40.5	43.8	7140	Atrophy	–	+	Retarded
(2nd)	16	43.5	45.0	8700	Atrophy	+	+	Retarded
2 (1st)	10	41.0	44.0	7710	------	+	+	------
(2nd)	17	41.2	44.0	7840	------	+	+	------
3 (1st)	5	36.5	41.0	6250	Normal	–	+	Retarded
(2nd)	6	37.0	42.0	7240	Normal	–	+	Retarded
4	4	37.0	43.0	5865	Atrophy	–	–	Retarded
5	31½	45.0	48.0	9700	Congenital cataracts	+	+	Idiot
6	9½	41.5	45.5	8445	Normal	+	+	------
7	36	45.0	53.0	12800	Normal	+	+	Idiot
8	4	38.5	39.5	4470	Disks pale	+	+	Idiot
9	8¾	---	---	5700	Atrophy	–	–	Retarded
10	5½	38.5	42.5	6310	Atrophy	++	+	Idiot
11	11	38.0	---	9405	Pallor in temporal halves	+	+	------
12	8	37.5	44.0	6380	Slight pallor	+	–	Idiot
13	5	41.0	40.5	5555	Normal	+	+	Retarded

CASE 1.—J. G., a white female infant, was first admitted to the hospital on Jan. 7, 1936, at the age of 7¾ months, with a complaint of defective vision. Four weeks before admission, the parents had noticed that the baby was taking less interest in her surroundings. There had been no fever, vomiting, or convulsions. The patient was a first child, born one month before term, with a birth weight of 2500 gm.

Physical examination on admission showed that the infant was well developed. She weighed 7140 gm. Circumference of the head measured 40.5 cm. and of the chest 43.8 cm. The anterior fontanel was small, barely admitting one fingertip. Examination of the eyegrounds showed the presence of bilateral optic atrophy, which was confirmed by the consulting ophthalmologist (Dr. A. B. Bruner). No cherry-red spot was visible. Muscles were normal in tone and size, but tendon reflexes were hyperactive.

TABLE III

DATA FROM LABORATORY STUDIES

CASE NO.	SEROLOGIC TESTS		SPINAL FLUID			ENCEPHALOGRAMS		REMARKS
	BLOOD	SPINAL FLUID	PRESSURE (DROPS PER MIN.)	GLOBULIN	NO. OF CELLS	VENTRICLES DILATED	CORTICAL MARKINGS	
1*	Neg.	Neg.	Normal	–	6	++++	Absent	Second admission. (See Figs. 1 and 2.)
2	Neg.	Neg.	Normal	–	5	++++	Present	Second admission.
3	Neg.	Neg.	------	–	0	+++	Present	Second admission.
4	Neg.	Neg.	56	–	0	++++	Present	(See Figs. 3, 4 and 5.)
5	---	Neg.	75	–	0	++++	Slight	------
6*	Neg.	Neg.	74	–	2	++	Slight on right. Absent on left	Necropsy.
7	Neg.	Neg.	Normal	–	0	++++	Present for 24 hours	------
8*	Neg.	---	0	–	--†	++	Absent	Overlapping sutures.
9	---	Neg.	------	±	0	+	Absent	------
10	---	Neg.	44	±	7	+	Absent	------
11	---	Neg.	60	–	0	++++	Absent	------
12	---	Neg.	62	±	4	++	Absent	------
13*	Neg.	Neg.	60	±	0	++	Absent	(See Figs. 6 and 7.) Necropsy.

*Case reported in detail in text.
†No pleocytosis.

Laboratory tests gave normal serologic reactions in blood and spinal fluid.

Encephalograms made after intraspinal injection of 75 c.c. of air showed that the air was fairly evenly divided between the two lateral ventricles, which were enormously dilated; there was also slight dilatation of the third ventricle. No cortical markings were seen. There was a small accumulation of air along the falx on the left side.

Neurosurgical examination by Dr. Claude S. Beck revealed the following condition: "Microcephaly is definite, and the internal hydrocephalus is advanced. Two lesions are present. The subarachnoid spaces of spinal canal, fourth ventricle, aqueduct, third ventricle, and lateral ventricle are patent. The external fluid pathway is blocked. Marked cerebral atrophy is present. Secondary optic atrophy is due to the general pressure."

This patient was admitted to the hospital a second time, at the age of 16 months. The circumference of the head had increased only to 43.5 cm. Encephalograms (Figs. 1 and 2) made at this time confirmed the original findings.

CASE 6.—D. S., a white male infant, was admitted on Sept. 2, 1936, at the age of 9½ months, because of convulsions which had begun five weeks earlier. This patient was a first child, born at full term in a hospital; labor was easy and lasted for four hours; no instruments were used. Birth weight was 3710 gm. The infant held his head erect at 6 weeks and sat alone at 6 months; he seemed to have some

Fig. 1. Fig. 2.

Fig. 1.—Case 1. Anteroposterior projection (erect) of encephalogram made on second admission, when patient was 16 months old, after intraspinal injection of 125 c.c. of air. The lateral ventricles are markedly dilated, the left being larger than the right. There is no air over the cortex. Circumference of head measured 43.5 cm.

Fig. 2.—Case 1. Lateral projection (prone), showing marked dilatation of lateral ventricles in posterior and descending portions and absence of air over the cortex.

stiffness in the arms since birth; congenital internal strabismus was present. At the age of 5 months it was noted that the anterior fontanel was small and was closing rapidly. Vision was considered normal up to the time of convulsions. There had been no acute illness.

Physical examination on admission showed a well-developed and well-nourished infant who weighed 8445 gm. Circumference of the head measured 41.5 cm. and of the chest 45.5 cm. The eyegrounds were reported normal. Reflexes were hyperactive. Laboratory tests of blood and spinal fluid were negative.

Encephalograms made after the injection of 75 c.c. of air showed moderate dilatation of the lateral and third ventricles. A few cortical markings could be made out on the right side but none on the left. The infant died six weeks after the encephalography.

Fig. 3.—Case 4. Photograph showing microcephaly, taken when patient was admitted at 4 months of age. Circumference of head measured 37 cm. and of chest 43 cm. Note that the oval outline of the top of the head has much the same curve as the outline of the lower portion of the face. (See also Tables I to III.)

Post-Mortem Examination.—Head: Pituitary gland was normal; meninges were normal; cerebral vessels, including the circle of Willis, were normal. The brain weighed 470 gm. Gross examination of the brain revealed nothing abnormal.

After fixation for six days, multiple sections through the cerebrum showed that the brain substance was unusually firm; there was some thinning of the cortex which was most marked in the occipital lobes; there was moderate dilatation of the lateral ventricles, the greatest being in the posterior horns.

Structures in the midbrain were of the usual size, shape, and position. Multiple sections showed no abnormality in the gross. The fourth ventricle was somewhat dilated, but the foramina of Magendie and Luschka were patent.

The cerebellum had the usual shape and conformation. It was not decreased in size in proportion to the cerebrum. Multiple sections showed the usual architecture, and there was no evidence of hemorrhage or inflammation.

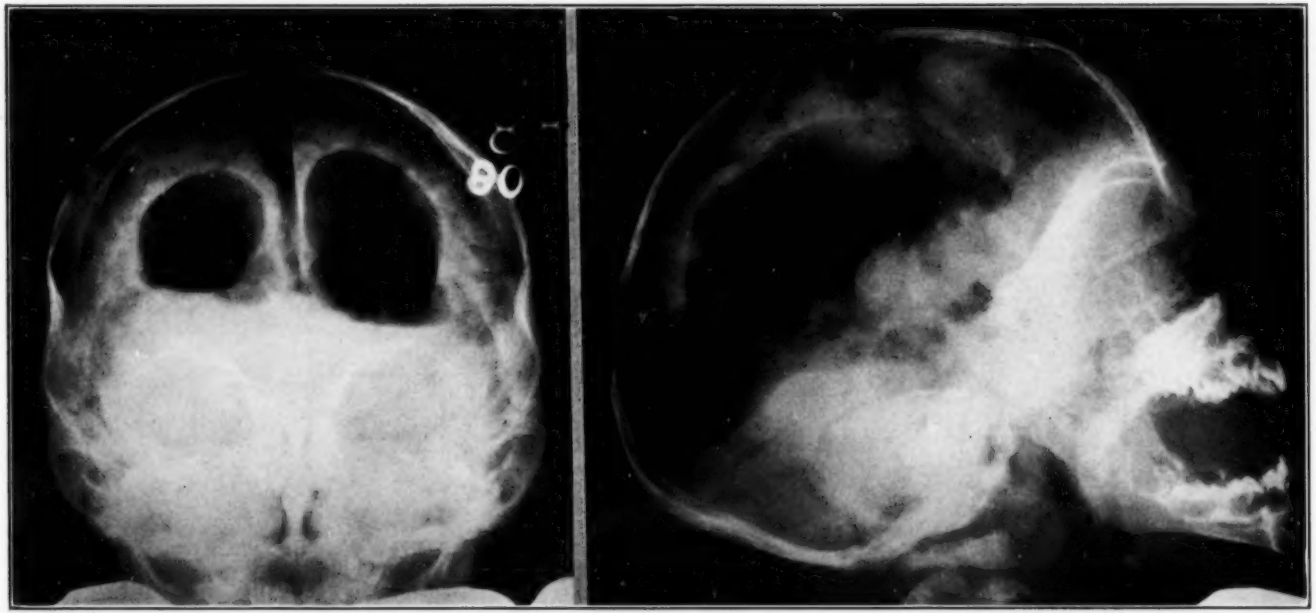

Fig. 4. Fig. 5.

Fig. 4.—Case 4. Posteroanterior projection (erect) of encephalogram made when patient was 4 months old, after injection of 90 c.c. of air. The lateral ventricles are unequally and markedly dilated, and there is air over the cortex on both sides, extending down along the falx.

Fig. 5.—Case 4. Lateral projection (prone), showing markedly dilated and abnormally shaped ventricles, with dilatation most marked in posterior portion.

Multiple sections through the pons and the medulla showed no abnormality in the gross. About 4 cm. of cord was examined; the external appearance was normal, and sections showed the usual architecture.

Histologic Examination.—Pituitary gland: The usual architecture persisted; basophilic cells predominated.

Brain: Sections of motor and sensory cortex showed the usual architecture. The cortical substance showed an increase in the number of cells. A large number of Betz cells were seen in the motor cortex; they had the usual appearance. A slight degree of edema and hyperemia was noted in the leptomeninges.

Sections of the thalamus and lenticulostriate nucleus showed the usual architecture. The ependyma of the ventricles was smooth and intact. There was no evidence of hemorrhage or abscess formation.

Sections of the cerebellum, the medulla, the pons and the spinal cord were normal.

CASE 8.—A. D., a colored female infant, was admitted on Sept. 20, 1937, at the age of 4 months, because of vomiting. This patient was the seventh child, born after three hours of labor, without instruments. Birth weight was 3520 gm. She had a hemorrhage from the umbilicus at the age of 10 days; two blood transfusions were required. Vision seemed to be poor.

Physical examination revealed a well-developed infant who weighed 4470 gm. Circumference of the head measured 38.5 cm. and of the chest 39.5 cm.

The anterior fontanel was closed at the time of admission (age 4 months), and there was a definite overlapping of the sutures such as might indicate an early closure owing to lack of normal intracranial pressure. This was the only case in this series which presented such marked overlapping.

The infant's eyes did not follow light, though the pupillary reflex to light was present. Examination of the fundi showed that the disks were pale and clearly defined.

Tendon reflexes were hyperactive; extremities were spastic.

Two attempts to obtain spinal fluid by lumbar puncture were unsuccessful; the first cisternal puncture yielded no fluid. At the time of the encephalography, moreover, no fluid was obtained from the spinal canal. Cisternal puncture was therefore resorted to. The fluid in the cistern was not under positive pressure and could be obtained only by making gentle suction with a syringe. Amounts of 2 c.c. of spinal fluid were replaced with like amounts of air until a total of 35 c.c. of air had been introduced. The fluid was clear. Encephalograms made after injection of 35 c.c. of air by way of the cistern showed that the lateral ventricles were about half filled with air; both were moderately dilated, the right one more so than the left. The anterior horns were quite blunt and the posterior horns had not filled. There was no air over the cortex.

CASE 13.—A. B., a white male infant, was admitted at the age of 5 months with complaint that the baby frequently stiffened out and did not take his feedings well. This patient was a second child, delivered in a hospital 1 hour and 28 minutes after the mother had been given 0.6 gm. of sodium amytal. Resuscitation of the baby required twenty minutes, and there were frequent cyanotic spells during the first four days. His weight on the second day was 2720 gm.

The infant had been examined first at the age of 6 hours by a pediatrician who was called because the infant seemed hypertonic. There was also trembling of the arms, which frequently were rotated inwardly. The legs were held extended but could be drawn up in a normal manner. Temperature was 37.7° C., pulse rate 144, and respiratory rate 48. The anterior fontanel was normal in size and was soft. Pupils reacted equally to light. There was no facial disparity on crying. Patellar reflexes were 2-plus on the right and on the left; Babinski reflexes were negative

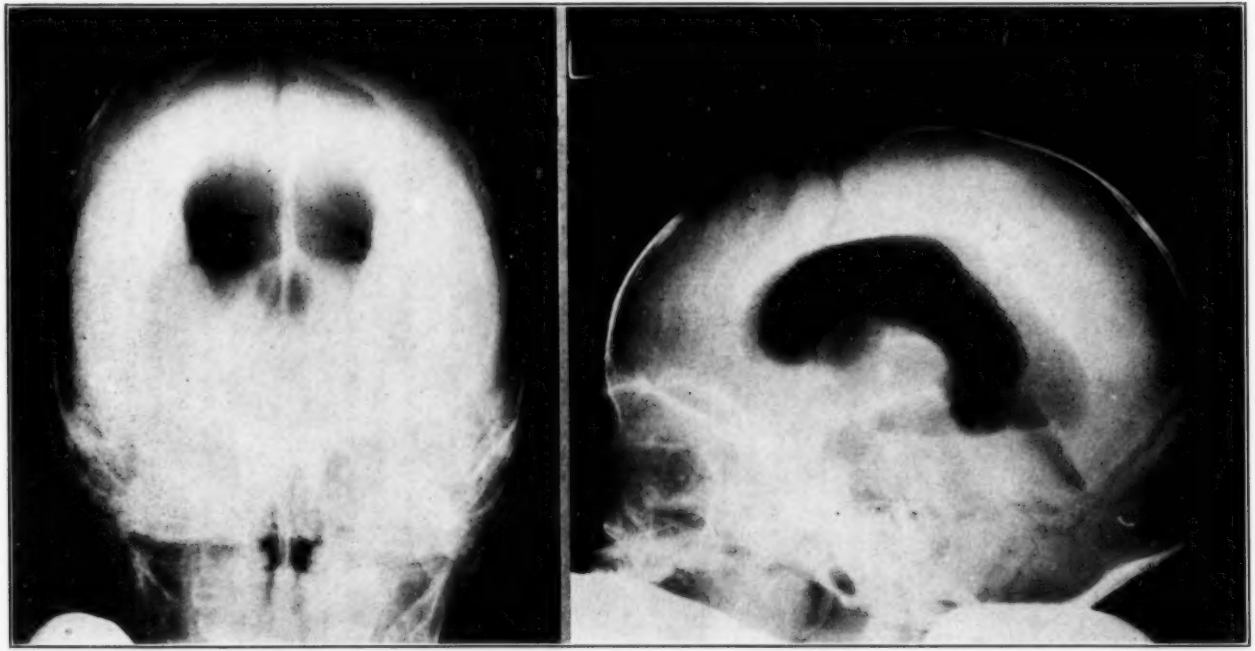

Fig. 6. Fig. 7.

Fig. 6.—Case 13. Anteroposterior projection (erect) of encephalogram made two days after admission, when patient was 5 months of age, after intraspinal injection of 80 c.c. of air. The lateral and third ventricles are moderately dilated, and there is no air over the cortex.

Fig. 7.—Case 13. Left lateral projection (erect), showing dilated ventricles and absence of air over the cortex.

on both sides; swallowing reflex was normal; gagging reflex was present; and the Moro reflex was absent. No masses suggestive of adrenal hemorrhage were palpated. A roentgenogram of the lungs was negative.

On the day following this examination the infant's condition seemed to improve, though the hypertonicity of the arms and legs persisted and the Moro reflex was still absent. The temperature reached a maximum of 38.6° C. The fontanel remained soft.

Cerebrospinal fluid obtained by lumbar puncture was under normal pressure, and three specimens contained respectively 7050, 5060 and 6000 red blood cells per cubic millimeter of blood. There was no difference in color among the three specimens. After centrifugation, the supernatant fluid was a pale straw color. Examination of the spinal fluid did not indicate the presence of any gross intracranial hemorrhage. On the day of birth the coagulation time of the blood was 5½ minutes and the bleeding time 1 minute.

The infant's condition improved daily, so that by the fifth day there was a normal Moro reflex and the other reflexes were also normal. He was discharged from the maternity hospital at the age of 14 days, weighing 3020 gm. The mother had an inadequate supply of breast milk; an additional formula was therefore required.

The infant's progress at home was only fair. The breast milk soon failed, and the bottle feedings were not taken avidly. The baby would frequently cry out and stiffen.

He was admitted to the Babies and Childrens Hospital at the age of 5 months. His weight at this time was 5555 gm. Circumference of his head measured 41 cm., of the chest 40.5 cm., and of the abdomen 36 cm. Body length was 61 cm. The anterior fontanel was soft and measured 3 cm. across. Eyegrounds were normal. There was hypertonicity in all four extremities. Reflexes were hyperactive; no ankle clonus was obtained. The infant frequently lay in the position of opisthotonos. Serologic reactions of blood and spinal fluid were negative; spinal fluid pressure was normal. Routine laboratory tests on spinal fluid were negative. Gum mastic reaction was negative. Content of calcium in the blood serum was 11.5 mg. and of phosphorus 5.2 mg. per hundred cubic centimeters of serum.

Encephalograms made after intraspinal injection of 80 c.c. of air showed that the lateral and third ventricles were markedly and uniformly dilated (Figs. 6 and 7). The posterior horns were short. No cortical markings were visible.

The infant died seven days after encephalography.

Post-Mortem Examination.—The brain weighed 700 gm. Convolutions were normally prominent; sulci moderately deep. Spinal cord was normal. Multiple sections of the brain after fixation in formalin for seven days showed the presence of moderate internal hydrocephalus which involved particularly the lateral ventricles but to a lesser degree also the third ventricle, the aqueduct, and the fourth ventricle. The lateral ventricles were approximately four or five times normal size and contained clear fluid. The foramina of Magendie and Luschka were patent, and there were no meningeal adhesions at the base of the brain.

Cerebral tissue was of normal color; there was a normal ratio of gray and white matter; there were no areas of hemorrhage. Scattered throughout the midbrain, particularly in the region of the lenticulostriate body but also extending posteriorly and anteriorly, were seen numerous small cystlike areas which were empty and had smooth linings. These varied in size from 1 to 4 mm. and were for the most part spherical in shape. There were no other areas of rarefaction, and the normal structures of the brain could be easily recognized. The medulla and the pons presented normal appearance on gross examination.

Multiple sections through the spinal cord were normal. The cranial nerves were not remarkable. The circle of Willis was normal in appearance, with a widely patent lumen.

Histologic Examination.—Pituitary gland: The normal architecture was preserved, and there was a preponderance of basophilic cells which, however, were scattered diffusely throughout the organ.

Sections of the cerebellum were normal. Sections of the spinal cord showed no significant pathologic change.

Brain: The meninges were intact and presented no abnormal pathologic change. The architecture of the cerebral hemispheres was somewhat disturbed in that it showed an arrested development; practically no nerve cells were present. There was an increase in some areas of glial tissue. In sections through the thalamus and the lenticulostriate region there was a compact arrangement of the cells lining the ventricles that suggested compression. Scattered throughout these sections were also seen numerous small and large areas which contained merely a loosely arranged tissue composed of widely separated fibers. Some of these areas surrounded vessels, and others did not. They corresponded to what has been described in the French literature as *états criblé* and *états vacuoles*. The blood vessels throughout were widely patent and contained erythrocytes with thin walls. There was no evidence of inflammatory disease or tumor.

A section through the cerebellum revealed that the Purkinje cells showed an abnormal eosinophilia of the cytoplasm, such as is seen in brains which are not developing normally.

Epicrisis.—The cause of death and the anatomic lesions present in this child were not clearly defined. The brain, which showed the most extensive lesions, would appear to have been the seat of congenital failure of development. This was evidenced by the absence of nerve cells in the cerebral hemispheres and the presence of the large and small cystic areas in the region of the midbrain. The finding of the eosinophilic cytoplasm in the Purkinje cells of the cerebellum also fitted in with this conception. However, the brain was of normal size. The internal hydrocephalus would appear to have been the result of atrophy and loss of brain tissue rather than the result of mechanical obstruction.

COMMENT

In a recent paper, Schreiber[16] has called attention to the possible relationship between the effect of sedatives administered to the mother and apnea of the newborn, with associated cerebral birth injury. Gross and microscopic changes in the brain are described. The gross end result pictured is severe cerebral atrophy, while the microscopic changes are described by Steiner[17] as "devastation areas." These changes appear as areas of patchy or focal necrosis which may be scattered throughout the central nervous system and, if they are large enough or numerous enough, they may become confluent. They are, apparently, due to anoxemia caused by permanent injury to small blood vessels.

Results of the complete post-mortem examination of Cases 6 and 13 do not resemble the findings so far reported in the literature for cases of cerebral anoxia. Perhaps more data from a larger series of cases would cause revision of the present views in this respect.

Nor does cerebral hemorrhage at birth seem to be the cause. The spasticity in the cases reported here is apparently of the extrapyramidal type.

Analysis of the data contained in Tables I to III permits of both negative and positive deductions.

On the negative side the following statements would appear to be justified:

1. Prematurity does not seem to be a significant cause.
2. Postnatal occurrence of acute infections of the central nervous system is not responsible.
3. Syphilis cannot be incriminated.
4. Convulsions which were present in almost half the cases cannot be considered a cause but rather an effect.

On the positive side:

1. Microcephaly is present, varying only in degree.
2. The anterior fontanel may be closed at birth or it may close during the early months of life.
3. Defective vision, accompanied by various grades of optic atrophy, occurs too frequently to be accidental.
4. Mental deficiency is probably present in all cases; in one case a reduction in the number of cells in the cerebral cortex was revealed on necropsy.
5. The encephalograms uniformly show dilated cerebral ventricles and usually an absence of cortical markings.
6. The relationship of cerebral anoxia at the time of birth must be held *sub judice* for the present, owing to lack of a more precise knowledge to date in this type of cases.

Most of the writers consulted seem to regard hydromicrocephaly as a prenatal defect. This conclusion seems justified, provided the diagnosis of cerebral anoxia at the time of birth can be ruled out.

The fact that it has been possible to collect a series of 13 cases out of 142 cases studied would indicate that hydromicrocephaly is more frequent than is indicated by its inconspicuousness in the literature.

The positive findings of small head, early closure of the anterior fontanel, defective vision, spasticity, mental deterioration, and enlarged ventricles are encountered with sufficient frequency to be considered a syndrome. An appropriate name for this syndrome is *hydromicrocephaly*.

SUMMARY

In a study of 142 pediatric neurologic cases, 13 cases of hydromicrocephaly were encountered. All presented dilated ventricles and early closure of the anterior fontanel. Frequent findings were spasticity, mental deterioration, and defective vision. The cases resemble one another so closely that it appears proper to group them in a single syndrome under the name hydromicrocephaly.

All encephalograms were made at the Babies and Childrens Hospital and were interpreted by Dr. C. H. York of that hospital. Post-mortem examinations were done at the Institute of Pathology, Western Reserve University.

REFERENCES

1. A Standard Classified Nomenclature of Disease, New York, 1935, The Commonwealth Fund, p. 453.
2. Cruveilhier, J.: Traité d'anatomie pathologique générale, **3**: 170, 1856, Paris, J. B. Baillière. (Passage translated by J. E. McClelland.)
3. Zappert, J.: Organic Diseases of the Nervous System, in Pfaundler, M. v., and Schlossmann, A.: The Diseases of Children, English translation **4**: 133, 1908, Philadelphia, J. B. Lippincott Co.
4. Ballantyne, J. W.: Manual of Antenatal Pathology and Hygiene, **2** (The Embryo): 367, 1904, Edinburgh, Wm. Green & Sons.
5. Bókay, J. von: Jahrb. f. Kinderh. **78**: 426, 1913; Monatschr. f. Kinderh. **42**: 109, 1929.
6. Reuss, A. R. von: Diseases of the Newborn, p. 354, New York, 1929, Wm. Wood & Co.
7. Cruveilhier, J.: Traité d'anatomie pathologique générale **4**: 75, 1862, Paris, J. B. Baillière et fils. (Passage translated by J. E. McClelland.)
8. Crothers, B., Vogt, E. C., and Eley, R. C.: Am. J. Dis. Child. **40**: 227, 1930.
9. Kruse, F.: Ergebn. d. inn. Med. u. Kinderh. **37**: 333, 1930.
10. Walker, A. E.: Am. J. Roentgenol. **32**: 437, 1934.
11. Brody, B. S., and McAlenney, P. F.: J. PEDIAT. **4**: 159, 1934.
12. Rupilius, K.: Wien. Klin. Wchnschr. **47**: 587, 1934.
13. Stankiewicz, R., and Vincenz, K.: Rev. franç. de pédiat. **9**: 482, 1933.
14. Arch. Dis. Childhood **11**: 97, 1936.
15. Crothers, B.: The Nervous System, in Practice of Pediatrics, edited by J. Brennemann **4**: chap. 1, p. 17, Hagerstown, Md., 1937, W. F. Prior Co.
16. Schreiber, F.: J. A. M. A. **111**: 1263, 1938.
17. Steiner, quoted by Schreiber.[16] Photomicrograph of "devastation areas" in section of cerebellum of infant born apneic is omitted in J. A. M. A. but is given in the reprint (Fig. 6) together with a detailed description (p. 17).

10515 CARNEGIE AVENUE

CASE FINDING IN TUBERCULOSIS

Study of a Group of Children With a History of Known Contact

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THE tuberculin test and a history of contact with a case of tuberculosis are two acknowledged means of finding cases of tuberculous infection in any group of children. The tuberculin test is used routinely on all patients admitted to the Children's Medical Service of Bellevue Hospital. Most of our cases are discovered by this means, although some children are admitted with the diagnosis. Because so much emphasis has been laid on the importance of a history of contact in the discovery of early cases of tuberculosis, we were interested in testing the value of this method of case finding on a large group of children with a known exposure to the disease. Through the courtesy of Dr. J. Burns Amberson, Director of the Adult Tuberculosis Service of Bellevue Hospital, we were able to study the child contacts of cases of tuberculosis on the adult wards during 19 months between 1936 and 1938.

All new patients admitted to the adult tuberculosis wards were questioned as to the presence of children in their families. Once or twice a month the names of all children who were in contact with recently admitted patients were given us, and the children were sent postcards urging them to come in for examination. In some cases several postcards were sent, but there was no intensive social service follow-up on the children who failed to respond. As a routine measure on the adult tuberculosis service, the importance of having all contacts examined is stressed, and they are advised to go to their District Tuberculosis Clinics, or to a private physician, for examination.

During the period covered by the study the names of 307 adults considered to have tuberculosis and having children in their families were given to us. Of these, there was no response from the contacts of 220 cases, possibly because many of the children were already being followed in their district clinics. The fact that the home had often been broken up by illness may also help to account for the rather large number who did not respond. Eighty-seven families responded either by letter or in person, and of these 21 families were excluded: 5 because the adult patient was eventually found not to have tuberculosis; 8 because they were uncooperative; 8 because they were being followed elsewhere and did not wish to come in to us.

The group studied comprised 66 families with 127 children between the ages of 23 days and 17 years. This figure does not include all the children exposed, as in some families all the contacts could not be induced to come in for examination. No study of the duration or in-

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timacy of contact was made, but in most cases the children had been living in the same apartment as the adult patient.

Table I shows the age, sex, and race distribution of the children tested, and the family relationships and the result of the sputum examination of the adult cases.

TABLE I

CHILDREN

MANTOUX	AGE				SEX		COLOR			
	0-2 YR.	3-5 YR.	6-11 YR.	12+ YR.	MALE	FEMALE	WHITE	NEGRO	PUERTO RICAN	FILIPINO
Negative* 36 (28%)	7	12	13	4	12	24	26	10		
Positive 91 (72%)	12	17	39	23	38	53	53	24	12	2

ADULT CONTACTS

	RELATION TO CHILDREN					SPUTUM‡	
	FATHER	MOTHER	SIBLING	GRAND-PARENT	AUNT†	POSITIVE	NEGATIVE
Negative 36 (28%)	9	8	6	1	1	18	6
Positive 91 (72%)	23	18	9	1		44	5

*Number negative to 1 mg. O.T. = 27
Number negative to 0.1 mg. O.T. = 7
†The same woman appears as a mother and as an aunt.
‡In three cases the sputum had not been examined.

It is interesting to compare the percentage of adult contacts with negative sputa in the groups of children with negative and positive Mantoux. Twenty per cent of the contacts of the children with negative Mantoux tests had negative sputa, while in the group of children with positive Mantoux tests only 9 per cent of the contacts had negative sputa, which agrees with the findings of Opie and McPhedran.[1] Nineteen of the 21 children with definite roentgenologic evidence of tuberculous infection were contacts of cases with positive sputa.

The children with negative Mantoux tests did not have roentgenograms but were referred to their District Tuberculosis Clinics for further observation to prevent missing the diagnosis on a very early case which had not yet developed a sensitivity to tuberculin.

All the children who had positive Mantoux tests had roentgenograms, and the plates were read by Dr. Edith M. Lincoln, who directed this study. Table II shows the roentgenologic diagnosis as related to the age group.

During the period of the study three of the children under 2 years with active primary tuberculosis died (two of tuberculous meningitis and one with extensive bilateral involvement and bronchogenic spread). One adolescent girl, in the group with a positive Mantoux test, whose

roentgenogram had been only suspicious on first examination developed chronic pulmonary tuberculosis about ten months later. Her history will be given in greater detail.

TABLE II

TYPE OF CASE AS RELATED TO AGE GROUP

X-RAY DIAGNOSIS	BIRTH-2 YR.	3-5 YR.	6-11 YR.	12+ YR.	TOTAL PATIENTS
Negative roentgenograms	4	13	32	21	70
Calcified lesions	1		3		4
Active primary tuberculosis	7	4	3	1	15
Chronic pulmonary tuberculosis			1	1	2

COMMENT

As might be expected, most of the children whose roentgenograms showed definite tuberculosis were found where the adult contact had had an extensive lesion and a positive sputum. However, two patients with definite cases, of whom one died of tuberculous meningitis, were contacts of a mother who had a minimal lesion and a negative sputum. These two patients are particularly noteworthy as one is often lulled to a false sense of security when an adult shows very little pathology on roentgenogram and a negative sputum. No matter how small her lesion, a tuberculous mother should not nurse her baby and preferably should have as little close contact with him as possible, at least during the first year.

The amount of infection in the children of a family varied. It was not unusual to find a child with a negative Mantoux test in a family where older and younger children had been infected. On the whole, there was a tendency for the younger children in a family to have the more extensive lesions.

Of the 91 cases with positive Mantoux tests studied, 58 per cent were white, 25 per cent were negro and 13 per cent Puerto Rican. But of the 22 definite cases of tuberculous infection discovered, 11 per cent were white, 25 per cent were negro, and 66 per cent were Puerto Rican. These numbers are too small, however, to be more than suggestive. We know that housing conditions of negroes and Puerto Ricans are very poor in New York City, and this may explain, particularly in the 6 Puerto Rican families, their relatively heavier infection.

The three children who died were all under 2 years old, and in each case they were contacts of a mother.

As might have been expected, the two cases of chronic pulmonary tuberculosis discovered were in adolescent girls. Their ages on first examination were 10 and 14 years. A brother was the contact for one of these girls; both parents of the other girl had tuberculosis.

L. H., 10 years old, had had a poor appetite but no other symptoms. On physical examination only very slight dullness and somewhat diminished breath sounds could be found.

The case of J. C., 14 years old, illustrates the need for continued supervision of contacts although the first roentgenogram seems merely suspicious. This girl, the contact of a brother, was in excellent general condition when first seen by us in May, 1937, with no complaints and nothing on physical examination to suggest tuberculosis. Her roentgenogram at this time showed a small area of clouding in the second right interspace, and she was referred to her District Tuberculosis Clinic where she was seen at regular intervals. In March, 1938, she came to our clinic again because she was told that she needed sanatorium care. She said that she had never felt better, was quite without symptoms, and so came to us for re-examination as she could not believe the diagnosis of her own clinic. Physical examination was entirely negative, and she appeared to be in good general condition. Her roentgenogram, however, showed very definite early chronic pulmonary tuberculosis. If she had not been under regular supervision, her lesion would undoubtedly have been much further advanced by the time symptoms had developed.

SUMMARY

1. During 19 months between 1936 and 1938, 127 children who were contacts of adult cases of tuberculosis were examined. Of these, 91 had positive Mantoux tests and 21 showed definite roentgenologic evidence of tuberculous infection.

2. Eighty-seven per cent of the 91 children with positive Mantoux tests were contacts of adult patients with positive sputa. However, two children with definite tuberculosis, of whom one died of tuberculous meningitis, were contacts of a mother who had only a minimal lesion and whose sputum was negative.

3. Two cases of chronic pulmonary tuberculosis were found among 125 children studied.

4. The three children who died were all under 2 years of age and in each case the mother was the contact.

5. A history of contact is an important lead in early case finding in tuberculosis in children, especially where the original patient has a positive sputum. This is strikingly shown in this highly selected group. It is significant, however, that even in this group two children with definite tuberculosis were discovered whose only contact with the disease had been a mother with a minimal lesion and a negative sputum. This is not a rare finding in any chest clinic and emphasizes again that, although a history of contact is very valuable, its absence does not eliminate the possibility of finding active tuberculosis.

REFERENCE

1. Opie and McPhedran: Am. Rev. Tuberc. 14: 347, 1926.

THE DIET OF ADOLESCENT GIRLS

With Special Reference to Nutritional State and Dental Caries

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IN AN era which is distinguished more by its scientific progress than by its social wisdom, it is of interest to determine, occasionally, what use is being made by the general population of the knowledge which is common property to the scientific world. The fundamental characteristics of an adequate diet, for example, are well established. Yet investigations, including this one, continue to reveal that popular diet habits are poor.

The present report is concerned with a survey of diet histories obtained for a series of 80 adolescent girls. The group is a normal urban public school sample which has been included in a comprehensive growth study previously described in detail by Jones[1] and by Pryor.[2] The intention of this report is to analyze the diet histories in themselves, and to relate the findings to two of the most objective of many collateral clinical observations, namely, nutritional status and dental caries. It was thought to be of special interest in that the children live in Oakland, Calif., in the shadow of a great university, where good food might be expected to be relatively abundant, and good diet education the rule. Although the sample represents a wide range of socio-economic status, the children come mostly from the "middle" class. The period covered is from 1932-1939.

Medical and anthropometric examinations have been made at semi-annual intervals since the spring of 1932. Information on diet was collected systematically on three occasions, in 1932, 1934, and 1938, when the average age of the children was 11.5, 13.5, and 17.5 years, respectively.

Schedule of dietary records:

1. In 1932, when the girls were in the fifth and sixth grades, a school counsellor visited the home and obtained from the mother (among other data concerning home regime) a record of the menus on the day preceding the interview. The use of milk and meat in the family was further checked in a budget analysis which included statements as to monthly expenditures for food.

2. In the fall of 1934, the children kept activity records for seven consecutive days, one section of the diaries being devoted to menus. Infor-

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From the Institute of Child Study, University of California.

Assistance in the preparation of these materials was furnished by the personnel of Works Progress Administration Official Project No. 665-08-3-30. Acknowledgment is also due the Oakland Public Schools for cooperation in the adjustment of school programs, making possible a series of interviews and physical examinations.

CALIFORNIA DIETARY CARD

ADOLESCENT STUDY

SCORE CARD COMPOUNDED FROM TEXAS, MASSACHUSETTS, AND SOUTH CAROLINA CARDS, WITH ADVICE OF DR. RUTH OKEY

FOOD	AMOUNT	VALUE EACH ITEM	TOTAL VALUE	EXAMPLES OF MAXIMUM AND MINIMUM DIETS AS SCORED IN SPRING 1938			
				MAXIMUM	SCORE	MINIMUM	SCORE
milk (any kind)	1½ pts. (3 glasses)	24	24	6 glasses × day	24	very rarely	0
butter	at least 1 × day	4	4	none	0	1 × day	4
fruit[x]							
raw, cooked dried	2 or more servings × day	10	20	4 servings × day	10	occasionally	3
raw—not citrus	at least 1 serving × day	5		at least 1 × day	5		
citrus or tomato	4 × week	5		at least 1 × day	5		
vegetables[x]							
leafy	4 × week	6	23	1 × day	6		
potato—white or sweet	1 × day	7		1 × day	7	1 × day	7
other than potato	2 × day	10		2 × day	10		
bread and cereals[y]							
whole grain	1 × day	7	14	4 × week	4	1 × week	1
refined	additional each day	1 } max.		1 × day	4	1 × day	4
	1 × day	4 } 7					
protein rich							
meat	1 serving any one × day	10	15	2 × day	15	2 × day	15
eggs							
legumes							
nuts							
additional of any	1 serving × day	5					
			100		90		34

[x]in fruits and vegetables either give 10 points for the fact of there being "2 servings" or no points at all for that item.

[y]whole grain cereal: rolled oats, oatmeal, corn meal; shredded wheat, shredded ralston, wheaties, puffed wheat, wheat hearts.

mation from the diary records was transferred to the California Dietary Score Card, in terms of an average for all of the days reported.

3. In the spring and fall of 1938, and again in the spring of 1939, the girls were questioned by a physician trained in clinical dietary observation. Information was solicited with regard to the food eaten the day before the interview, plus a supplementary statement of the food usually eaten. This material was recorded on the score card, and for each individual the two 1938 records were averaged together for one score. The 1939 interview was confined to a special inquiry among 48 of the 80 girls concerning their consumption of starches and sweets.

A sample of one of the best and one of the worst diets reported in the last interview is presented here as representative of the kind of records which are the raw data of this study (Table I). Scoring of the records is also shown.

The scoring was done on the basis of a score card compounded with the help of Dr. Ruth Okey from similar published cards previously used in Texas, Massachusetts, and South Carolina. The results of the Texas study, reported by J. Whitaere,[8] have been especially useful as a point of orientation for our own.

The starches and sweets were scored on the following scale:

	PARTIAL SCORE PER SERVING	MAX. SCORE PER WEEK	SWEETS ONLY
Bread, each slice	1	30	
Potato, rice, spaghetti	1	14	
Cake, cookies, pie	1	14	14
Jam, jelly, honey	1	7	7
Sugar, each teaspoonful	1	14	14
Candy, each piece	3	21	21
	—	100	56

Intake of vitamin concentrates was not investigated.

DIET ADEQUACY

The general impression gained from the interviews was that the girls had no clear working concept of what constitutes an adequate diet program, nor any strong conviction that it would be advantageous to follow one.

The following tabulation summarizes the averages of the scores at the three inquiries. They are plotted in Fig. 1.

AGE	SCHOOL GRADE	YEAR	N	MEAN DIET SCORE	STANDARD DEVIATION
11.5	5,6 (elementary)	1932	77	63	16
13.5	8 (junior high)	1934	71	52	12
17.5	11,12 (senior high)	1938	78	56	15
Average of all 3 years			79	57	11

Comparison of the average total diet score with the scores of Texas white girls shows our *grand average* of 57 to be lower than theirs of 67. However, the difference is not statistically significant. Furthermore, the scoring devices in the two studies differ slightly. Either figure is astonishing when one realizes the implication: that children both in Texas and in California were eating foods which contained on the average only two-thirds of the essentials usually recommended.

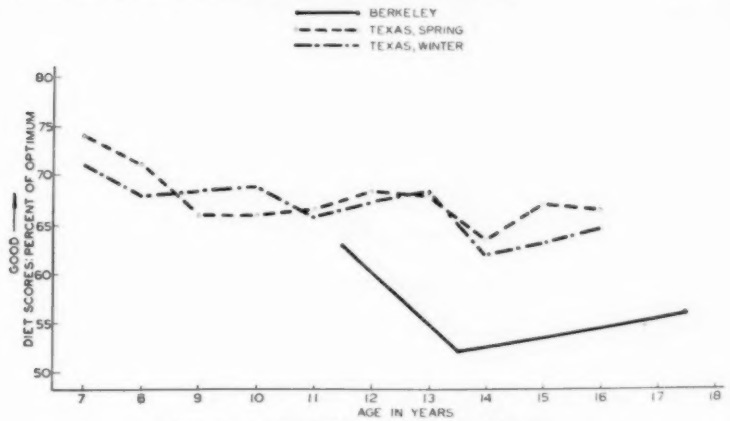

Fig. 1.—Average diet score at several ages.

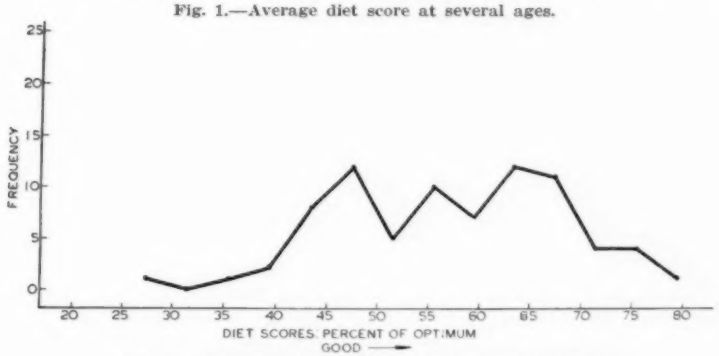

Fig. 2.—Frequency distribution of average diet scores.

The *distribution* of our total average score is shown in Fig. 2.

Statistical evaluation of these scores does not permit much weight to be put on the variation between the several *age levels*. Nevertheless, when the values are plotted against figures from the Texas study as in Fig. 1, the three curves show a comparable drop after 11.5 years. It seems possible to say that at the earlier years the diets tend to score appreciably higher than they do later. Since the peak of the growth spurt in girls is close to 11.5 years, this finding fits in with the belief that the diet is more adequate when the appetite is greater, as it is during periods of rapid growth.

INDIVIDUAL DIET ITEMS

Having found that the total average diet is only around 57 per cent of the optimum and that no diet scored above 80 per cent when all three inquiries were averaged, it is of interest to discover where the deficiencies lie. The relative adequacy of the several food classes is shown in Fig. 3. The intake of protein-rich foods was the only one which approached adequacy. The other elements were all definitely deficient, showing averages that were between 40 and 60 per cent of the optimum. When 1932, 1934, and 1938 were graphed separately they showed almost precisely similar patterns. The general picture confirms Dr. Whitacre's statement that "the majority of school children are a very long way from meeting present day recommendations for the use of milk, fruits, vegetables and whole cereals."

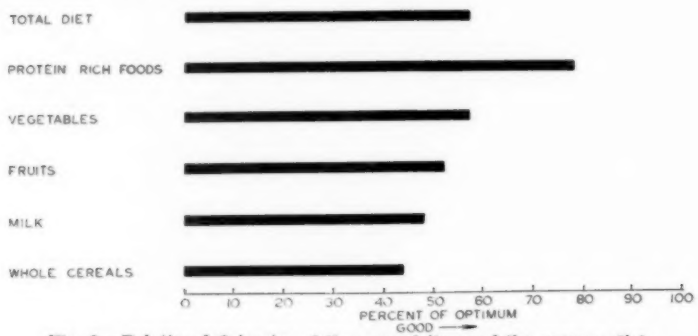

Fig. 3.—Relative deficiencies of the several items of the average diet.

STARCHES AND SWEETS

At this point the question arises: If children are eating too little of nutritionally valuable foods, are they eating too much of something else, or are they starving?

The deficient diets are distributed about equally between thin and fat girls. There is thus no correspondence between inadequacy and clinical evidence of caloric deprivation. The answer must be, therefore, that some foods are eaten in excess. It has not, however, been possible to demonstrate decisively what this excess is. Partly, this is because of the scoring device used, in which no food is scored higher than the optimum, even though more than the optimum is consumed, i.e., two quarts of milk would not rate higher than three glasses.

One obvious place to look for the excess is in nutritionally indifferent starches and sweets. It was hoped that a correlation would exist between low diet scores and high carbohydrate scores. No such correlation was found, and indeed it might very well be masked by the variation in caloric requirements between different individuals. Another factor which

would tend to mask such a finding is that the special inquiry concerning carbohydrates was made only in 1939, when the girls almost universally said that they were eating fewer sweets than had been their custom in the previous four years. Nevertheless, the impression gained from the menus was that spaghetti, white bread, desserts, and candy were often taking the place of nutritionally more important foods.

CLINICAL IMPLICATIONS

The relation between diet and health is known to have many expressions. Commonly accepted as being at least under the partial influence of diet are nutritional status, energy, resistance to infections, dental caries, bowel action, and acne. Of these, only the data on nutrition and caries were sufficiently complete to permit analysis.

Nutritional status: The subjects were rated on a 5-point scale, which sought to evaluate correct weight for body build:

1. Markedly underweight.
2. Moderately underweight.
3. Optimum weight.
4. Moderately overweight.
5. Markedly overweight.

The ratings were arrived at by two quite separate maneuvers. First, complete growth curves were made for each girl, showing the trend of the height-weight curve in relation to the height bicristal curve. This graphic method, described in 1935, uses the bicristal diameter together with the height as an index of breadth of body build. Each curve was rated by two observers, according to the nearness of the weight line to its prediction path; an illustrative graph is shown in Fig. 4.

The second index of weight status was obtained from a judgment by three separate observers (two physicians and a student of nutrition) of the appearance of each girl in standard photographs at three ages (11, 13.5, 16.5). These photographs consist of front, back, and side views taken of each girl at each semiannual examination, under fixed conditions of camera, frame, distance, and light.

The graphs and judgments were then compounded into one rating on the 5-point scale above described. The frequency distribution of the ratings is shown in Fig. 5. If the girls with optimum weight are considered as one group, and all others pooled into another, they give two series of about equal number.

Diet calculations, separately for these contrasting nutrition groups, gave the following results. The variabilities are practically the same as for the whole group, listed in the first table: about 12 points.

	OPTIMUM WEIGHT DIET		UNDERWEIGHT AND OVERWEIGHT DIET	
	N	SCORE	N	SCORE
Total average diet	40	59	38	55

Although the differences between the scores for total diet adequacy in the two groups is encouragingly in the right direction, with the better tallies going to the better shapes, the critical ratio between the two means is only a little over 2.

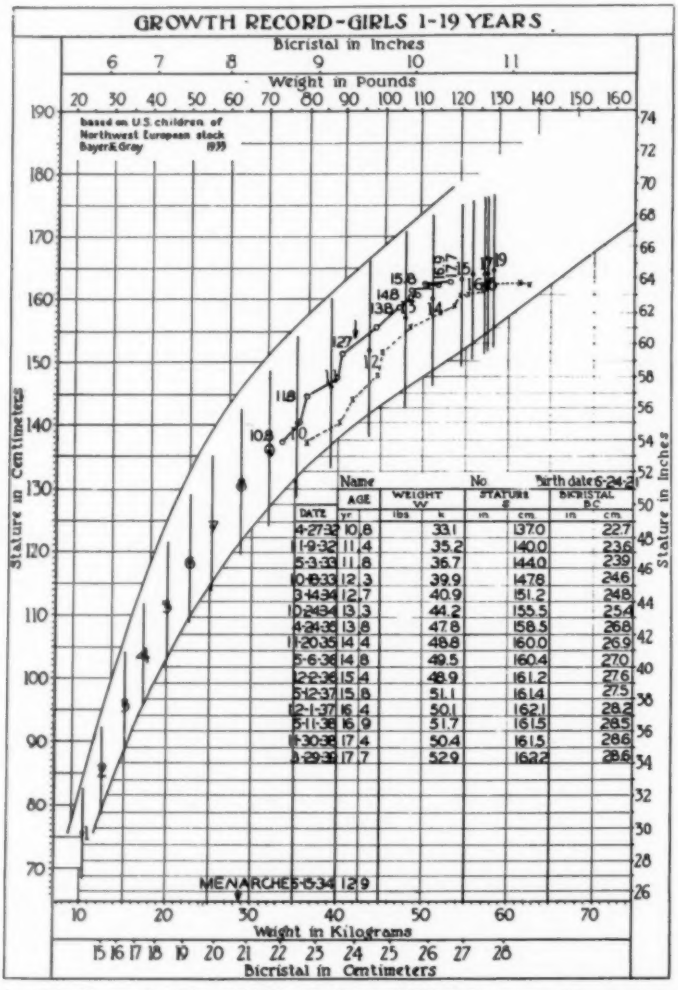

Fig. 4.—Growth graph. The solid line is the weight-height curve. The dash line is the height-bicristal curve.

DENTAL CARIES

Since we have found that these so-called normal girls follow a relatively poor diet and that half of them deviate from their optimum weight, it is not surprising to find that by age of 17.5 years they have rather poor teeth.

With a problem as complex as that of dental caries, it would, of course, be folly to expect a clearly demonstrable relationship between caries and nutrition in so casual a clinical study. Too many factors are already known to play their part in dental health, to which dentists are constantly adding new and greater refinements. Besides the primary considerations of constitutional endowment, dental structure, alignment, and occlusion, such details as the exact location of cavities, the *Bacillus acidophilus* count in the mouth and the acid-base reaction of the saliva, are receiving increasing attention. Concerning the rôle of diet, Simmonds[4] has summarized the present status of dental caries in relation to nutrition in a recent article. She condenses the available data into two practical suggestions:

> "1. If an individual is susceptible to tooth decay, he should reduce his intake of all sweet foods to a minimum. In this way he will keep the flora of his mouth low in those organisms known to be acid formers. Starches and fats should be his main energy foods.
>
> "2. In addition to keeping the intake of sweet foods low, each person should plan his diet so that all factors, including vitamin D, are present in abundance."

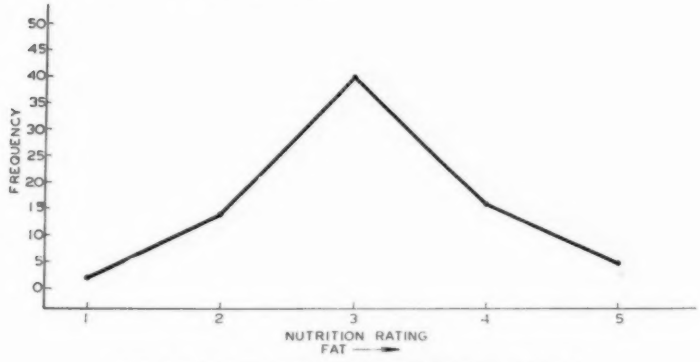

Fig. 5.—Frequency distribution of nutrition ratings.

In the present study, a relation was sought between the available diet and dental data through an analysis first of group findings, and then of outstanding individual cases.

First, a word must be said as to how dental caries was counted. At each six-month examination, the physician has enumerated and identified all visible teeth, has noted the teeth which showed cavities or fillings and teeth which were reported extracted because of caries. The present tallies are confined entirely to counts made on the permanent teeth. Teeth extracted for orthodontic reasons were not included in the count, although

note has been made of striking malocclusion, malalignment, and of orthodontic appliances. This method of counting conforms to a concept recently proposed in a Public Health Survey, where caries experience is defined as the total number of permanent teeth or tooth surfaces which are decayed, missing or filled, and is referred to for brevity as the D.M.F. count. Small cavities on interproximal surfaces were certainly missed. But for the many girls under regular dental supervision, the appearance of new fillings reflected their condition with fair accuracy.

The frequency distributions of the caries scores (D.M.F. count) in 1932, 1934, and 1938 are shown in Fig. 6. Means and standard deviations for the several years are:

YEAR	N	MEAN D.M.F. COUNT	STANDARD DEVIATION
1932	77	2	2
1934	71	4	2
1938	78	9	4

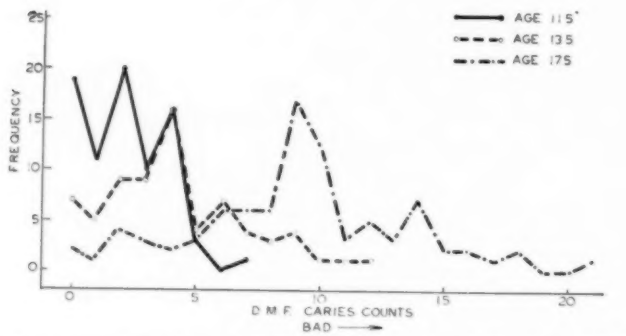

Fig. 6.—Frequency distribution of D.M.F. Caries counts at the age of 11.5, 13.5, and 17.5 years.

At the last medical examination there were only two girls without obvious caries experience; eight girls had each more than fifteen diseased teeth. This rapid increase of decay in adolescence is similar to findings reported by Moore[6] in a series of 80 girls followed from ages 6 to 20.

Unsuccessful attempts were made to relate the caries susceptibility for the group to total diet adequacy, or to the consumption of milk or sweets. This is not surprising. At least two considerations help explain the negative findings.

First, the diets were in general poor; no group of children in the series were on consistently good enough diets so that the protective effect would have had an opportunity to exert itself.

Second, the inquiry on intake of starches and sweets, considered among the most fruitful factors to investigate, was made in the spring of 1939, long after the damage was done. As noted above, the girls generally

stated that they now ate less candy and sweets than had been their custom earlier in their high school careers. Furthermore, several of the girls with the very worst teeth showed the lowest carbohydrate scores; the state of their dentures, combined with the admonitions of their dentists had presumably persuaded them to cut down on luxury carbohydrate consumption.

A special investigation of *selected individuals*, however, not only illustrates the complexities of the problem, but also contributes a little to its illumination. So that this dental report should not rest solely on medical evidence, the two girls who on routine examination showed the soundest teeth, and three of those with the most damaged dentures were expertly studied by inspection and x-ray in June, 1939. Russell O. Collins, D.D.S., generously made this supplementary investigation on four of the girls, and Thos. O. Robinson, D.D.S., contributed the information on a fifth. Table II summarizes the more pertinent findings. It may be noted that although dental examination revealed more caries in every instance than had been discovered on medical inspection, the dental findings, in general, corroborated the medical records. The cavities in Cases A and B were manifest only on the x-rays.

The findings are summarized in Table II.

Case A.—Fair teeth in family; very good structure, good care, good diet, very little caries which is only now beginning. The diet was more noteworthy for its limitation of sweets than for its nutritional completeness.

Case B.—Good teeth in family, very good structure, poor care, poor diet, caries beginning about the age of 17 years, but proceeding rapidly.

Cases C and D.—Poor teeth in family, poor structure, poor care, fair diet, caries beginning early and progressing constantly.

Case E.—Poor teeth in family, poor structure, good professional care, poor diet until a recent reform, caries beginning early and progressing constantly.

Cautiously, these summaries may be interpreted for what light they throw on the role which diet has played in the caries production of these five girls. Only Case A has had even a moderately favorable diet. Constitutional factors and care were also advantageous here. It may be supposed that favorable nutrition has until very recently protected good equipment from breaking down. In contrast to this situation, Case B shows as good a constitutional endowment as Case A, but care has been very lax, and diet outstandingly poor (her adequacy score is the one illustrated in Table I as the lowest in the group). It is fair to assume that a grossly unfavorable diet has contributed to the recent but now rapid breakdown of a natively good set of teeth. The remaining three cases are presumably the end result of poor endowment plus unfavorable diet. Besides this, only the girl in Case E received good dental care. But she is also markedly obese and shows many stigmas of endocrinopathy.

TABLE II

	DENTAL CARIES										CASE STUDY					
	AGE	FAMILY		TEETH		ANATOMY		CARE			NUTRITION	DIET		CARIES*			
CASE	LAST EXAMINED	MOTHER	FATHER	SISTERS	BROTHERS	GENERAL CONDITION	COLOR	OCCLUSION	BRUSHED	DENTAL	RATING	ADEQUACY	STARCH + SWEETS	BEGAN	D.M.F. TEETH (M.D.)	D.M.F. TEETH (D.D.)	D.M.F. AREAS (D.D.)
A	18	fair	good but paradentosis	0	0	very good	yellow	very good	A.M. P.M.	reg.	4	good	low	present	0	3	4
B	20	good	good	fair fair fair	fair fair fair	fair	yellow	very good	A.M.	none	4	poor	high	1938	0	12	17
C	18	very poor	very good	good poor poor	0	poor	dull white	good	A.M. P.M.	not reg.	3	fair	high	early	21	22	44
D	18	very poor	very poor	poor	0	poor	dull white	good	A.M. P.M.	not reg.	2	fair		early	18	23	52
E	17	fair	very poor	good	0	poor	soft white	good	A.M.	reg.	5	poor (improved recently)	high	early	18	26	49

*In the column identified by (M.D.), the count shown is that made by the physicians on routine medical inspection, the other two columns show dentist's accurate counts, made with the help of instruments and x-ray films.

Whether even the best of diets and care could have prevented decay in these three cases is certainly open to question.

In other words, it would seem that a favorable diet can protect a good set of teeth, an unfavorable diet can contribute to the disintegration of an equally good set of teeth, while an originally poor set of teeth will disintegrate very rapidly when the diet is poor, even though dental care may be good.

SUMMARY AND CONCLUSIONS

A report has been made on data collected with regard to dietary habits, nutritional status, and dental caries in the course of a longitudinal study on some 80 normal adolescent girls. The report is largely based on the facts coming from examination in 1932, 1934, and 1938, when the girls were respectively 11.5, 13.5, and 17.5 years old.

Diets have been scored with regard to total and fractional nutritional adequacy. A separate inquiry on starches and sweets was scored for 1939.

Analysis of the diets permits the following conclusions:

1. The diets are generally poor, containing on the average only about two-thirds of recommended essentials.

2. The greatest deficiency is in vegetables, fruits, milk, and whole cereals.

3. Although no correspondence between low diet adequacy and high carbohydrate intake could be demonstrated for individuals, the total impression given by group menus was that the deficiency in nutritionally desirable foods was largely made up by starches and sweets.

Clinical investigation showed that:

1. Judged by photographs and graphs of body build, about half the group could be considered as having optimum weight. The other half were divided quite evenly between overweight and underweight. The girls with optimum weight showed a diet adequacy which was slightly superior to that of the latter groups.

2. Dental caries was evaluated for the group by making counts of decayed, missing, or filled permanent teeth (D.M.F. count) as they appeared at semiannual medical inspection. The counts rose from an average of 2 diseased teeth at 11.5 years of age to an average of 9 at age 17.5 years of age, the range being from 0 to 21 D.M.F. teeth at the last medical examination.

No statistical relationships for the group between poor teeth and poor diet—either inadequate or high in starch and sweets—could be demonstrated. Probably no diets were good enough consistently to exert a protective influence.

However, a detailed case study was undertaken in which the factors of constitution, care, and diet were all considered. It appeared likely that favorable diet had protected one set of natively good teeth, that

unfavorable diet had contributed to the breakdown of another good set of teeth, and that poor diet had played an incalculable rôle in the decay of three natively poor sets of teeth.

In *conclusion*, it may be said that, if clinical benefit is to come from the application of available nutritional knowledge, the public must be much more vividly educated to the details and values of an optimal diet.

REFERENCES

1. Jones, H. E.: J. Educ. Research **31**: 561, 1938.
2. Pryor, H. B.: J. Pediat. **8**: 52, 1936.
3. Whitacre, J.: Texas Agr. Exp. Sta. Bull. No. 489, 1934.
4. Bayer, L. M., and Gray, H.: Am. J. Dis. Child. **50**: 1408, 1935.
5. Simmonds, N.: Am. J. Pub. Health **28**: 1381, 1938.
6. Klein, H., Palmer, C. E., and Knutson, J. W.: Pub. Health Rep. **53**: 751, 1938.
7. Moore, M. M.: J. Dentistry **3**: 77, 1936.

GASTROINTESTINAL ALLERGY IN CHILDREN

Clinical Reactions Resulting From Ingestion of Foods

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IN A previous report[1] we described the roentgenographic changes in the gastrointestinal tract resulting from food hypersensitiveness. The clinical symptoms observed at that time seem to warrant a separate description.

This paper, accordingly, deals with clinical symptoms observed after the oral administration of foods. In a few instances, rectal administration was also tried. Thirty subjects with proven clinical sensitivity to definite foods were studied.* The skin test reactions of the patients to these foods were also evaluated.

In the radiographic studies we had used an ordinary barium meal consisting of barium sulfate and water. At a later date, for the comparative study, the specific offending allergen was added to the barium mixture. Sufficient allergen was given to produce gastrointestinal disturbances, the amount needed determined by previous clinical trials. The allergen was added to the barium mixture without the knowledge of the patient. In most instances, when orally administered, the barium suspension disguised the taste of the added allergen.

In the studies dealing with rectal administration, a control enema had been made with barium sulfate suspended in water; in the comparative study, the specific allergen was mixed with the barium sulfate.

In some instances, after the rectal administration of the offending food, severe and alarming symptoms resulted, emphasizing the potency of atopens when administered by this route. Despite every attempt to ascertain proper dosage, pronounced symptoms and even constitutional reactions occurred in some patients. These experiences soon impressed us with the danger of administering allergen by rectum. Consequently, this type of investigation was discontinued early.

About one week was allowed to elapse between the control study and that concerned with the allergen.

TYPE AND FREQUENCY OF SYMPTOMS

The subjects were selected because they reacted predominantly with gastrointestinal symptoms. However, we observed during this work symptoms of wider variety, which are summarized in Table I. The manifestations resulting from the rectal administration of the antigen are noteworthy and are listed separately in the same table.

From the Division of Allergy of the Jewish Hospital.

*Eighteen children were studied in addition to the twelve reported on in the previous communication.

TABLE I

TYPE AND FREQUENCY OF SYMPTOMS

SYMPTOMS FOLLOWING ADMINISTRATION	NO. OF CASES	PER-CENTAGE
Oral Administration (30 Subjects)		
Nausea	13	43
Vomiting	7	23
Abdominal pain	6	20
a) in the region of the umbilicus	4	13
b) in the left upper quadrant	1	3
c) in the epigastrium	1	3
Constitutional reactions	2	7
Oral and pharyngeal symptoms	2	7
No symptoms observed	8	27
Rectal Administration (16 Subjects)		
Abdominal pain	12	75
a) in the region of the umbilicus	7	43
b) in the upper abdomen	2	12
c) in the left lower quadrant	1	6
d) generalized pain	2	12
Tenesmus	4	24
Nausea	1	6
Sensation of fullness in abdomen	1	6
Constitutional reaction	1	6
No symptoms observed	3	18

SYMPTOMS FOLLOWING ORAL INGESTION

Nausea was the most frequent reaction, occurring in 43 per cent of the group. It cannot be related to the ingested barium since nausea did not follow the plain barium meal.

Vomiting occurred in 23 per cent of the cases, in most instances occurring several minutes after ingestion of the barium-allergen meal. In two instances, it was delayed one-half hour and one hour, respectively.

Abdominal pain was encountered in 20 per cent of the cases, the location and nature of the pain varying. The children usually pointed to a definite region. In most instances, it was near the umbilicus. In some, the epigastrium or left upper quadrant was designated. Pain was usually cramplike. A few described it as an unpleasant sensation of fullness.

Oral and *pharyngeal* manifestations were observed in two instances. One patient complained of "burning of the mouth." The other described it as a "tickling and itching" sensation of the throat. Circumoral erythema and swelling of the lips were associated with these symptoms. Oral and pharyngeal symptoms were met less frequently in the present investigation than in the previous clinical trials when the allergen was given without barium.

No clinical symptoms were discernible in eight children. This was probably due to the small amounts of allergen which were used. With larger amounts of the causative foods, clinical manifestations might have occurred.

SYMPTOMS FOLLOWING RECTAL ADMINISTRATION

Abdominal pain shortly after rectal administration of the allergenic substance occurred in 75 per cent of patients studied. In several instances, the pain was severe, cramplike, and localized in the middle or upper abdominal regions. Severe generalized cramplike pain was experienced by the patient in whom a constitutional reaction subsequently developed. The control meals of barium sulfate and water, without allergen, were not productive of symptoms in any of these patients.

Tenesmus, i.e., an urgent desire to expel the allergen-containing barium, was observed in 25 per cent of the children. This occurred immediately after rectal administration and was of much greater intensity than that observed when a plain barium enema was introduced.

CONSTITUTIONAL REACTIONS

Constitutional reactions occurred in two patients after oral ingestion and in one patient following rectal administration. Those following oral ingestion were of moderate intensity, but the reaction following rectal administration was severe and required epinephrine for its control. The generalized nature of the symptoms (cutaneous, gastrointestinal, and respiratory) is described in detail in the protocols which follow.

Vomiting frequently occurred shortly after the ingestion of a highly offending substance. This undoubtedly resulted in the curtailment of the amount of allergen absorbed. Had it not been for this mechanism, probably protective, it is possible that a greater number of generalized reactions would have ensued.

Constitutional reactions resulting from oral ingestion and rectal administration are presented herewith:

CASE 2.—D. S., a white male aged 6 years, had been subject to attacks of asthma for the past two years. A positive family history of allergy on the maternal side was elicited. Nausea, vomiting, and, occasionally, asthma occurred after the ingestion of egg.

Skin Test.—Intracutaneous testing with an extract of egg containing .0001 mg. N per c.c. resulted in a four-plus reaction.

Atopen Used.—Two teaspoonfuls of raw egg in a 6 oz. mixture of barium sulfate in water.

10:00 A.M.: Mixture was swallowed.

10:05 A.M.: Patient complained of a burning sensation in the throat.

10:10 A.M.: Sneezing, lachrimation, suffusion of the eyes, and clogged nose were noted. The patient complained of epigastric distress.

10:20 A.M.: Circumoral erythema and swelling of the lips were observed. Numerous small urticarial lesions appeared on the forearm, arms, and neck. There was generalized pruritus.

10:25 A.M.: Patient complained of cramplike pain in the umbilical region.

10:30 A.M.: The patient was nauseated and vomited a small portion of the test meal.

10:40 A.M.: Moderate dyspnea, wheezing, lachrimation, and nasal congestion occurred. The child rubbed his nose and yawned frequently. The ocular conjunctivae were injected. The nasal turbinates appeared pale and swollen. There was a profuse rhinorrhea.

10:45 A.M.: Patient complained, "I feel sick," and held his upper abdomen, complaining of cramplike pain.

11:00 A.M.: The itching had subsided, and the urticarial lesions were diminished in number and size. Patient appeared improved.

1:00 to 4:00 P.M.: During this interval, there were three watery bowel movements.

CASE 22.—T. McG., white male aged 14 years, had asthma of six years' duration. Ingestion of nut was followed by swelling of the lip and epigastric distress.

Skin Test.—Intracutaneous testing with an extract of almond nut containing .05 mg. N per c.c. resulted in a one-plus reaction.

Atopen Used.—Nut (almond and Brazil nut, pulverized), 1 teaspoon suspended in an 8 oz. mixture of barium sulfate in water.

8:00 A.M.: Allergen-containing meal was ingested.

8:10 A.M.: Patient complained of burning and tightness in the throat and nausea.

8:30 A.M.: Nausea increased noticeably.

8:45 A.M.: The upper lip was considerably swollen; a large wheal was observed on the labial mucous membrane. Patient complained of persisting burning and tightness in the throat, nausea, and epigastric discomfort. Wheezing was heard in the chest.

9:05 A.M.: There were paroxysms of sneezing and rhinorrhea.

9:30 A.M.: The signs and symptoms described above still continued. Copious lachrimation occurred. The eyelids were swollen, and the conjunctivae were injected.

9:45 A.M.: Edematous swellings spread rapidly from both sides of the nose to the cheeks.

10:00 A.M.: The mucous membrane of the pharynx was markedly congested and glistening. Three well-defined wheals were noted on the soft palate. The uvula was edematous.

10:05 A.M.: Copious lachrimation, nasal congestion, and wheezing continued.

11:00 A.M.: The lachrimation diminished. Swelling of the lip subsided. Patient still complained of nausea.

11:55 A.M.: Nausea persisted.

12:00 A.M. to 10:00 P.M.: During this interval there was a gradual subsidence of all symptoms and signs.

CASE 20.—L. S., a white male aged 6 years, was subject to asthmatic attacks. There was a positive history of allergy in the immediate family. His mother reported that the ingestion of nut was followed by nausea, vomiting, and abdominal pain.

A barium enema without allergen revealed normal filling of the large intestines. There were no subjective symptoms. One week later an allergen-containing enema was administered.

Skin Test.—Intracutaneous testing with extracts of almond, walnut, and Brazil nut containing .005 mg. N per c.c. resulted in four-plus reactions.

Atopen Used.—Two teaspoonfuls of ground nut mixture (almond, walnut, and Brazil nut) in a 6 oz. mixture of barium sulfate and water.

10:30 A.M.: The allergen-containing enema was administered, and immediately the patient complained of severe generalized cramplike abdominal pain.*

*Marked persistent spasm of the transverse colon was observed on fluoroscopic and roentgenographic examination at this time.

10:33 A.M.: The barium enema was evacuated.

10:40 A.M.: A constitutional reaction was observed. This consisted of cyanosis, dyspnea, faintness, rapid pulse, congestion of the conjunctivae, and a generalized urticaria with intense pruritus. These symptoms were controlled by a hypodermic injection of 5 minims epinephrine hydrochloride (1:1,000).

ACUTE ALLERGIC ABDOMEN

Acute abdominal crises where the symptoms and signs simulate an acute surgical abdomen have been observed by the writers on two occasions.

One such case is described:

CASE 5.—M. L., a female of allergic lineage, aged 8 years, had been subject to recurring attacks of asthma for two years. Until the age of 3 years, the child had vomited following the ingestion of egg. Since then, several trial feedings of egg have been followed by cramplike abdominal pain, usually within two or three hours.

An oral test meal of barium sulfate was not followed by any symptoms. Two weeks later, a similar study was made when half of a raw egg was added to the barium meal.

Skin Test.—Intracutaneous tests with an extract of egg (.01 mg. N per c.c.) gave a three-plus reaction.

Atopen Used.—One tablespoon of raw egg in a 6 oz. mixture of barium sulfate and water.

9:50 A.M.: The allergen-containing meal was ingested.

10:00 A.M.: The patient complained of nausea. A small amount of the mixture was vomited. An equivalent amount was fed to the patient.

10:00 to 11:00 A.M.: Patient felt perfectly well during this entire period.

11:10 A.M.: The child was seized with severe cramplike abdominal pain which prostrated her.

11:20 A.M.: Paroxysms of abdominal pain recurred at ten- to fifteen-minute intervals. During these paroxysms, lasting three to five minutes, the child screamed and doubled up with pain which was localized at a point just above the umbilicus. Deep palpation elicited tenderness in the epigastric region. Neither rigidity of the abdominal wall nor rebound tenderness was present.*

12:30 P.M.: Patient wheezed moderately.

1:30 P.M.: There was an abrupt cessation of pain and patient recovered immediately from her disability.

SKIN TESTS

Cutaneous reactions, both by scratch and intradermal methods, ranged from negative or slight to markedly positive reactions. It is noteworthy that those patients demonstrating very pronounced gastrointestinal disturbances were most frequently the ones who gave marked positive skin reactions. This is illustrated in Table II.

The not infrequent failure of cutaneous tests to correlate positively with clinical symptoms of food hypersensitiveness points to the limitation of this diagnostic procedure per se.†

*The concomitant roentgenologic findings during this episode revealed spasm of the pylorus, which probably was responsible for the pain.

†Within recent years several authors have commented upon negative skin reactions in food hypersensitiveness.[3-7]

The absence of cutaneous reactions in some of our patients possibly may be due to the existence of several clinical forms of food hypersensitiveness, some of which are not based on a reagin mechanism.[8]

TABLE II

SKIN REACTIONS RESULTING FROM INTRACUTANEOUS TESTING OF CHILDREN WITH GASTROINTESTINAL ALLERGY

CASE NO.	PATIENT	SEX	AGE IN YEARS	ALLERGEN	NITROGEN CONTENT IN MG. PER C.C., OR DILUTION	DEGREE OF REACTION
1	J. C.	M	3	Egg	0.0001	++++ (×)*
2	D. S.	M	6	Egg	0.0001	++++ (×)
3	P. K.	M	6	Egg	0.0001	++++ (×)
4	P. G.	M	6	Egg	0.0001	+++ (×)
5	M. L.	F	8	Egg	0.01	+++
6	R. L.	F	7	Egg	0.01	+++
7	J. C.	F	5	Egg	0.01	++
8	R. E.	M	12	Egg	0.01	++
9	A. K.	M	7	Egg	0.01	+
10	T. T.	M	8	Egg	0.01	+
11	I. S.	M	12	Egg	0.01	+
12	D. S.	F	12	Egg	0.01	0
13	J. R.	M	6	Egg	0.01	0
14	S. F.	M	5	Egg	0.01	0
15	N. LeB.	M	11	Egg	0.01	0
16	I. L.	F	9	Egg	0.01	0
17	R. G.	F	6	Codfish	0.00001	++++ (×)
18	J. L.	M	10	Codfish	0.00001	++++ (×)
19	I. S.	M	13	Herring	0.0001	+++
20	L. S.	M	6	Walnut	0.005	++++ (×)
21	I. S.	M	11	Almond	0.05	+++
22	T. McG.	M	14	Almond	0.05	+
23	D. LeP.	M	4	Wheat	0.05	++
24	B. F.	F	8	Wheat	0.05	+++
25	M. C.	F	7	Cabbage	1:5	++++ (×)
26	B. S.	M	12	Sweet corn	1:5	+++
27	R. K.	M	10	Oats	1:10	+
28	A. K.	F	5	Milk	1:10	0
29	A. DeM.	M	7	Milk	1:10	0
30	M. V.	F	9	Milk	1:10	0

*x indicates patients who had marked clinical disturbances following ingestion of the allergenic food.

The technique employed consisted of the intracutaneous injection of about 0.02 c.c. of the testing extract. Reactions were classified according to the size of the wheal and the extent of the erythema.

SUMMARY AND CONCLUSIONS

The ingestion of specific foods provoked varied clinical disturbances in allergic children under controlled conditions.

These children differed considerably in their individual skin test reactions to specific foods.

REFERENCES

1. Fries, J. H., and Zizmor, J.: Am. J. Dis. Child. **54**: 1239, 1937.
2. Alexander, H. L.: Ann. Int. Med. **5**: 52, 1931.
3. Vaughan, W. T.: J. Immunol. **20**: 313, 1931.
4. Rowe, A. H.: J. ALLERGY **5**: 135, 1934.

5. Gay, L. P.: J. A. M. A. **106**: 969, 1936.
6. Bray, G. W.: Recent Advances in Allergy, Philadelphia, 1937, P. Blakiston's Son & Co.
7. Tuft, L.: Clinical Allergy, Philadelphia, 1937, W. B. Saunders Company.
8. Walzer, M. (in Coca, A. F., Walzer, M., and Thommen, A. A.): Asthma and Hay Fever in Theory and Practise, Springfield, Ill., 1931, Charles C. Thomas, p. 413.

For additional bibliography see:

Smith, H. C.: Arch. Int. Med. **3**: 350, 1909.
Schloss, O. M.: Am. J. Dis. Child. **3**: 341, 1912.
Kerley, C. G.: New York State J. Med. **36**: 1320, 1936.
Finkelstein, Laroche, Halberstadt, Finizio, Schloss, Talbot, and Park (cited by Rowe, A. H.): Clinical Allergy, Philadelphia, 1937, Lea & Febiger, p. 577.

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TREATMENT OF RICKETS WITH MINIMAL VIOSTEROL DOSAGE

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NUMEROUS studies on the treatment of rickets with viosterol have been made, yet there appears no unanimity of opinion regarding the minimum dosage necessary for curative purposes. Lewis[1] states that "from reports in the literature and from our own experience concerning the curative dosage of viosterol, one may conclude that the minimum dosage of this antirachitic agent for cases of mild or moderate rickets in negro infants is somewhere between four and ten drops; in other words, between 880 and 2,200 U.S.P. units." A review of some of the recent articles,[2, 3, 4, 6] as well as Lewis' own study, impressed us that this rather large dosage range is based upon observations of ambulatory clinic subjects, and can represent only findings as they appeared under the conditions of such studies. Gerstenberger[5] has established the need for a two-week observation period before beginning antirachitic therapy to exclude cases of spontaneous healing. This criterion has been neglected in many studies.

When the provision of an antirachitic becomes necessary for a large group of indigent patients and those with limited means, the question of determining adequate minimal dosage is more than an academic one.

During the course of some observations on rickets, the opportunity was presented to observe the results of the administration of a small dosage of viosterol to Negro infants with moderate and severe rickets. The results of these findings form the subject of this report.

PROCEDURE

Thirteen Negro infants between the ages of 8 and 28 months were hospitalized for fifty-six days on a ward provided for this study between February and April. Complete physical examinations were done on all the children. All had negative blood Wassermann and Mantoux tests (second strength P.P.D.). Daily temperature, pulse, respiration, and weight were recorded for each child. Diets suitable for the age and weight were offered freely, but all foods with known and significant amounts of vitamin D were excluded. On admission, x-rays of the wrists were made, and blood calcium and phosphorus levels were determined. This was repeated at the end of two weeks. After the two-week period of observation 800 U.S.P. units of viosterol were given daily to each infant by the same person (head nurse), during the entire experimental

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period. X-ray films of the wrists and blood calcium and phosphorus determinations were repeated at 7, 14, 28, and 42 days after treatment was begun.

RESULTS AND DISCUSSION

Table I summarizes the blood calcium and phosphorus results. Table II condenses our x-ray interpretations of the observation period and the six-week treatment period.

TABLE I

CALCIUM AND PHOSPHORUS DETERMINATIONS
(MG. PER 100 C.C.)

NO.	NAME	AGE IN MONTHS	SEX		OBS. PERIOD		WEEKS AFTER 800 UNITS VIOSTEROL DAILY			
					BEGIN.	END	1	2	4	6
1	R. L.	19	M	C	11.5	10.1	10.5	11.6	10.8	11.3
				P	3.0	3.2	3.5	4.0	4.6	5.3
2	E. G.	8	F	C	10.2	10.8	11.2	--	11.4	10.6
				P	3.8	3.2	4.0	--	4.2	6.0
3	V. D.	11	F	C	--	10.6	10.9	10.1	12.5	11.2
				P	--	3.0	2.7	2.6	5.5	4.7
4	E. H.	16	M	C	9.6	9.6	9.5	11.3	10.5	11.1
				P	3.6	5.0	4.6	5.3	5.3	5.0
5	B. B.	13	F	C	10.2	9.8	10.5	10.6	11.2	10.8
				P	4.4	3.8	3.4	3.9	3.4	4.4
6	H. P.	10	M	C	9.7	9.8	10.3	9.3	10.2	10.9
				P	3.0	2.7	4.4	4.6	4.7	4.4
7	S. B.	12	M	C	10.2	9.2	9.2	10.0	10.4	10.2
				P	3.6	3.4	3.1	3.8	4.5	4.7
8	D. R.	28	F	C	9.1	10.5	9.2	10.2	11.2	11.1
				P	2.2	2.7	2.8	3.6	4.7	3.4
9	S. S.	14	F	C	10.1	9.9	9.8	10.9	10.4	10.9
				P	2.8	2.8	3.0	3.3	3.4	3.8
10	R. B.	11	M	C	9.1	9.4	9.4	9.9	10.2	11.4
				P	3.8	3.3	2.5	2.6	3.5	4.0
11	C. B.	20	M	C	9.1	9.5	10.2	11.3	11.9	11.9
				P	1.4	2.7	2.4	4.2	4.0	3.0
12	R. E.	17	M	C	10.0	10.2	10.1	10.9	10.9	10.6
				P	2.5	3.7	2.8	3.0	4.2	4.4
13	J. S.	19	M	C	9.2	10.2	10.5	10.6	11.1	10.9
				P	3.0	3.5	3.4	3.3	2.9	3.6

In general, the final calcium and phosphorus show an increase over the initial determinations. This is more evident for phosphorus than for calcium. The marked degree of rickets in some of the cases may explain the rather irregular course of the calcium.

Though opportunity was not afforded us to keep these infants for a twelve-week therapeutic period, the amount of healing in all cases on 800 units of viosterol progressed to a rather surprising degree. In Cases 10-13, inclusive, x-ray films showed beginning healing at the end of the second week. We believe our experiences are an experimental confirmation of the minimal dosage suggested by Lewis for moderate, and we would add moderately severe, rickets.

TABLE II

DEGREE OF HEALING OF RICKETS AS SHOWN IN X-RAY FILMS

FIGURE	NAME	OBS. PERIOD		WEEKS AFTER 800 UNITS VIOSTEROL DAILY		
		BEGIN.	END	1	4	6
		A	B	C	D	E
I	R. L.	0	0	+	++	+++
II	E. G.	0	0	+	++	+++
III	V. D.	0	0	+	++	++±
IV	E. H.	0	0	+	+	++
V	B. B.	0	0	+	++	+++
VI	H. P.	0	0	+	++	++±
VII	S. B.	0	0	+	++	+++
VIII	D. R.	0	0	+	++	++±
IX	S. S.	0	0	+	+±	++±
X	R. B.	0	0	0	+	++
XI	C. B.	0	0	0	+	+
XII	R. E.	0	0	0	+	++
XIII	J. S.	0	0	0	+	+±

+ indicates beginning healing
++ indicates advanced healing
+++ indicates almost completely healed
0 indicates healing not begun
± indicates interclass variability.

SUMMARY

1. Thirteen Negro infants, ages 8-28 months, with moderate and severe rickets were hospitalized under controlled conditions for 56 days; during 42 days each child received 800 U.S.P. units of viosterol.

2. There was absence of spontaneous healing of the rickets during a two-week observation period.

3. All infants but four with severe cases showed beginning healing at the end of the first week of therapy.

4. Eight of the 13 were almost completely healed at the end of the sixth week.

CONCLUSIONS

1. From these observations it appears that 800 U.S.P. units of viosterol is an adequate minimal curative dosage for moderate and severe rickets, in Negro infants.

2. The disparity in findings in ambulatory clinic subjects may be due either to the lack of regular administration of the antirachitic agent or the lack of an adequate total diet.

REFERENCES

1. Lewis, J. M.: J. PEDIAT. **10**: 155, 1937.
2. Barnes, D. J., Brady, M. J., and James, E. M.: Am. J. Dis. Child. **39**: 45, 1930.
3. Eliot, M. M., Nelson, E. M., Barnes, D. J., Brown, F., and Jeuss, R. M.: J. PEDIAT. **9**: 355, 1936.
4. Hood, J. Suder, and Ravitch, Irene: J. PEDIAT. **11**: 521, 1937.
5. Gerstenberger, H. J.: J. A. M. A. **104**: 816, 1935.
6. Shelling, D. H., and Hopper, B. S.: Bull. Johns Hopkins Hosp. **58**: 137, 1936.

RECOVERY FROM SALMONELLA (PANAMA) MENINGITIS IN AN INFANT TREATED WITH SULFAPYRIDINE

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THE following case report is recorded for the following reasons:

(1) To our knowledge it is the first recognized case of meningitis caused by *Salmonella panama*, a recently described organism.

(2) The patient was treated successfully with sulfapyridine,† blood transfusions, and repeated lumbar drainage.

CLINICAL DATA

History.—B. R., a 1-month-old female infant, was born Nov. 15, 1938, in the Strong Memorial Hospital. Delivery was aided by the application of low forceps after a labor lasting 23 hours. The birth weight was 3300 gm. The infant was normal. The prenatal and newborn periods were normal. Upon a feeding of breast milk, complemented with a formula of cow's milk and karo syrup, she regained her birth weight by the time of discharge from the hospital on the tenth day of life.

On Dec. 14, 1938, at the age of 1 month, the patient was admitted to the Pediatric Service because of vomiting and blood in the stools. The vomiting had continued to some extent for 1 week prior to admission. Two days before admission, the stools became soft and frequent. Fresh blood was observed in two of the movements.

There was no known exposure to enteritis, but the maternal grandmother, who had cared for the baby, was admitted to another hospital on Nov. 29, 1938, because of gastroenteritis. *Bacterium dysenteriae dispar* was isolated from her stool.

Examination and Course.—Physical examination of the infant revealed no significant abnormal findings. There was no evidence of dehydration, nor were there signs of infection of the central nervous system. The eardrums were dull. The weight was 3700 gm. Temperature was normal.

Blood counts were as follows: Red blood cells, 5.05 million; hemoglobin, 12.5 gm.; white blood cells, 15,400; polymorphonuclears, 37 per cent; lymphocytes, 61 per cent; mononuclears, 2 per cent. The stained smear was normal; platelets were abundant. The urine was normal. A stool was yellow, semiformed and contained no pus, mucus, or blood.

During the first eight days in the hospital, the temperature remained between 37 and 37.5° C. except on the fifth day when it rose to 38.5° C. and promptly returned to normal. At this time a mild upper respiratory infection was evident, and the stools became diarrheal and frequent—nine per day.

On the ninth day after admission, the temperature suddenly rose to 40.5° C. The spleen became palpable, and the white blood cells increased to 24,000. On the following day the temperature was 40° C., and the anterior fontanel appeared full. The extremities were somewhat spastic, but there was no neck rigidity.

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*Working under a grant from the Fluid Research Fund of the University of Rochester.

†We are indebted to Merck & Co., Inc., for the supply of sulfapyridine.

Pneumonia of the right upper lobe was suspected, but a roentgenogram failed to confirm this diagnosis. Later in the day the first lumbar puncture was performed. The specimen of spinal fluid removed was moderately turbid but was under normal pressure. It contained 1300 cells per cu.mm., 92 per cent of which were polymorphonuclear leucocytes. The direct smear of the sediment showed the presence of pleomorphic gram-negative bacilli resembling *Hemophilus influenzae*. Accordingly *H. influenzae* antiserum and fresh complement were injected intrathecally and intravenously.

The cultures of the original and of subsequent specimens of spinal fluid, however, revealed pure growths of an actively motile, gram-negative bacillus. An identical organism was cultured from the blood stream and from the stools. The biochemical and serologic attributes of this organism will be discussed later.

The diagnosis of purulent meningitis was made and the organism regarded as a member of the Salmonella group, probably *Salmonella paratyphi B* or *Salmonella enteritidis*. The treatment consisted in the administration of fluids, blood transfusions, and repeated lumbar punctures. The administration of sulfapyridine was entirely upon an experimental basis. The therapeutic results as reflected by the changes which occurred in the spinal fluid are illustrated in Table I.

TABLE I

THERAPEUTIC CHART OF B. R. CASE OF MENINGITIS CAUSED BY SALMONELLA PANAMA

DATE	MAXIMUM TEMPERATURE ° C.	SPINAL FLUID VALUES						CULTURES			TREATMENT
		TOTAL CELLS PER CU. MM. FLUID	PERCENTAGE OF POLYMORPHONUCLEAR LEUCOCYTES	PROTEIN IN MG. PER 100 C.C. FLUID	SUGAR IN MG. PER 100 C.C. FLUID	CHLORIDES IN MG. PER 100 C.C. FLUID	SULFAPYRIDINE CONTENT IN MG. PER 100 C.C.	SPINAL FLUID	BLOOD CULTURES	STOOL CULTURES	
12/24/38	40.0	1300	92	250	16	538		+	+	+	Blood transfusion, 60 c.c. Sulfapyridine, 1.0 gm. orally
12/25/38	39.8						4.0	+	+		
12/26/38	39.5	13300						+			Blood transfusion, 60 c.c. Sulfapyridine continued 1.0 gm. per day orally from 12/24/38 to 1/12/39. Total dosage—20 gm.
12/27/38	38.5	7150		375			3.0	+			
12/29/38	39.0	11150		500	10		3.7	+			
12/31/38	38.5	1275		375			4.0	0			
1/ 2/39	38.7	2300		250			1.4	0			
1/ 4/39	38.0	1512		300	17		2.9	+	0		
1/ 8/39	37.6	240	75	200	21			0	0		
1/10/39	37.4	145	50	150	20		2.3	0			
1/16/39	37.3	70		70	26	673	0.0	0		0	
1/21/39	37.0									0	
3/ 8/39	39.5	2400	75	250	13	667		+	0		Second admission; sulfapyridine, 1.0 gm. per day orally for 6 days
3/ 9/39	39.7	1273			28			0		+	
3/10/39	39.0	462									
3/12/39	37.7	330		90	30	714		0			
3/13/39	37.0	120		75	27	690	0.1				
3/16/39	37.2									+	
3/20/39	37.3	40	0	50	28	720		0			
3/23/39	37.2									+	
3/26/39	37.0									0	

A surprisingly progressive improvement in both the spinal fluid findings and the physical signs followed, and the patient was discharged apparently cured on Feb. 2, 1939, fifty days after admission. The weight at this time was 4680 gm.

The baby weighed 5760 gm. on Feb. 21, 1939, and examination at this time revealed her to be apparently normal.

On March 7, 1939, the patient developed a mild upper respiratory infection with a temperature of 38.3° C. The following day the temperature was higher and two convulsions occurred. The respirations were rapid, and the child vomited. She was readmitted to the hospital. Examination revealed that the anterior fontanel was tense and bulging and that the neck was rigid.

The spinal fluid was turbid and contained 2400 cells, 75 per cent of which were polymorphonuclear leucocytes. The culture again was positive for the same type of organism isolated during the first admission.

The blood count revealed 4.35 million red blood cells; hemoglobin, 11.5 gm.; white blood cells, 33,500, 75 per cent of which were polymorphonuclears and 25 per cent lymphocytes.

During the second admission, cultures from the blood and from the nasopharynx did not reveal the Salmonella organism, but it was recovered from the stools upon three occasions.

It was apparent that a recurrence of the meningitis had occurred 3 months after the first attack. Again the therapy consisted of repeated lumbar punctures and the administration of sulfapyridine. The temperature gradually returned to normal by the fourth day and remained so as the infection of the meninges rapidly cleared. The patient was discharged for the second time on April 1, 1939, at which time she weighed 6400 gm. and appeared to be entirely normal.

During the 4 months since the second discharge she has been examined at regular monthly intervals. There has been no evidence of further recurrence of the infection and no residual effects. The physical and mental development has been normal.

BACTERIOLOGIC FINDINGS

The organism isolated from the blood and from the stools was identical with that cultured from the spinal fluid so far as morphologic, biochemical, and serologic criteria were concerned. It was an actively motile, gram-negative bacillus and will be identified in the following discussion as the Rochester strain.

Biochemical Reactions.—Acid and gas were produced by growth in dextrose, maltose, mannite, xylose, arabinose, dulcitol, and trehalose. Lactose, inositol, sucrose and salicin were not fermented. Indole was not produced, but hydrogen sulfide was formed and an acid reaction was obtained in Jordan and Harmon's tartrate medium.

Serologic Reactions.—Saline suspensions of the organism were agglutinated by the diagnostic antiserums according to the following titers: *S. enteritidis* antiserum, 1280; *S. paratyphi B* antiserum, 1280. The patient's serum at this time agglutinated a stock strain of *S. enteritidis* 1 to 160 and the Rochester strain, 1 to 160, but failed to agglutinate a stock strain of *S. paratyphi B.*

The following agglutination titers were obtained on serum drawn from the patient on January 28, 1939, 35 days after the onset of men-

ingitis: *S. paratyphi A*, 20; *S. paratyphi B*, 20; *S. suipestifer*, 20; *S. enteritidis* (102), 640; *S. enteritidis* (103), 40; *S. enteritidis* (99), 20; *S. aertrycke*, 40; Rochester, 320.

A few absorption reactions performed with the patient's serum resulted as follows:

SERUM	ABSORBING ANTIGEN	TEST ANTIGEN	TITER
Patient's	Rochester	Rochester	0
Patient's	Rochester	*S. enteritidis* (102)	0
Patient's	*S. enteritidis* (102)	*S. enteritidis* (102)	0
Patient's	*S. enteritidis* (102)	Rochester	320
Patient's	*S. aertrycke*	*S. aertrycke*	0
Patient's	*S. aertrycke*	Rochester	160

Since the biochemical and the preliminary serologic reactions suggested that the Rochester strain was particularly related to *S. enteritidis* or to *S. paratyphi B*, further serologic studies were carried out. Immune serums were prepared in rabbits by the intravenous injections of killed suspensions of *S. paratyphi B*, of *S. enteritidis*, and of the Rochester organism.

Table II shows the results of the agglutination studies in which the unknown organism was compared with these two organisms.

TABLE II

AGGLUTINATION-ABSORPTION REACTIONS COMPARING THE UNKNOWN STRAIN, ROCHESTER, WITH S. ENTERITIDIS AND WITH S. PARATYPHI B

ANTISERUM	ABSORBING ANTIGEN	TEST ANTIGEN	TITER
Rochester	------	Rochester	5120
	------	*S. enteritidis* (102)	2560
	------	*S. paratyphi B*	640
	Rochester	Rochester	160
	Rochester	*S. enteritidis* (102)	320
	Rochester	*S. paratyphi B*	320
	S. enteritidis (102)	Rochester	1280
	S. enteritidis (102)	*S. enteritidis* (102)	1280
	S. paratyphi B	Rochester	5120
	S. paratyphi B	*S. paratyphi B*	80
S. paratyphi B	------	*S. paratyphi B*	1280
	------	Rochester	1280
	S. paratyphi B	*S. paratyphi B*	640
	S. paratyphi B	Rochester	80
	Rochester	*S. paratyphi B*	640
	Rochester	Rochester	0
S. enteritidis (102)	------	*S. enteritidis* (102)	10240
	------	Rochester	320
	S. enteritidis (102)	*S. enteritidis* (102)	5120
	S. enteritidis (102)	Rochester	0
	Rochester	*S. enteritidis* (102)	5120
	Rochester	Rochester	0

In view of our failure to identify clearly the strain as one of these two types of Salmonella organisms, a subculture was submitted for study to Dr. P. R. Edwards of the Kentucky Agricultural Experiment Station. We are indebted to him for what is apparently the correct identification of the unknown strain. His report was as follows: "The

organism in question is *Salmonella panama*. The antigenic formula is I IX:lv:1, 5. As to the method used for identification, it was the one recommended by Kauffmann. First, the heat-stable antigens are identified and then the specific and nonspecific heat labile antigens are typed. I think the relationship to *S. enteritidis* is accounted for by the fact that the somatic (heat stable) antigens of that type and *S. panama* are identical or nearly so."

After receiving the results of Dr. Edwards' studies, we obtained a sample of *S. panama* antiserum from Dr. Fritz Schiff, who has encountered this organism in a study of intestinal infections in infants, and a subculture of the original Jordan-Kauffmann strain from the American Culture Collection.

The results of agglutination-absorption tests comparing our organism with the known strain of *S. panama* are illustrated in Table III. It is

TABLE III

AGGLUTINATION-ABSORPTION STUDIES COMPARING THE UNKNOWN STRAIN, ROCHESTER, WITH A KNOWN STRAIN OF SALMONELLA PANAMA

ANTISERUM	ABSORBING ANTIGEN	TEST ANTIGEN	TITER
Rochester	------	Rochester	10240
	------	*S. panama*	2560
	Rochester	Rochester	0
	Rochester	*S. panama*	0
	S. panama	Rochester	320
	S. panama	*S. panama*	0
S. panama	------	*S. panama*	1280
	------	Rochester	320
	S. panama	*S. panama*	0
	S. panama	Rochester	0
	Rochester	*S. panama*	320
	Rochester	Rochester	0

apparent from the study that the Rochester strain completely removes the agglutinins from the Rochester antiserum for both the Rochester strain and for the known strain of *S. panama*. Absorption of this antiserum with *S. panama* removes all the agglutinins for *S. panama* and significantly reduces those for Rochester.

In like manner, the agglutinins of the *S. panama* antiserum for *S. panama* and for the Rochester strain are completely removed by absorption with *S. panama*, while those for the Rochester are completely removed and those for *S. panama* are reduced from 1280 to 320 by absorption with the Rochester strain. These studies seem to indicate a very close serologic relationship between the two organisms and to confirm the findings of Dr. Edwards.

DISCUSSION

Meningitis caused by organisms of the Salmonella group is highly fatal. Bahrenburg and Ecker[1] found 35 cases reported in the literature during the period 1908 to 1937. Thirty-two of the 35 patients died.

Of the 35 reported cases, the reports of 15 were too incomplete to be classified. The group of 20 cases discussed by the authors, which included a thoroughly studied case of their own due to *S. schottmülleri*, were distributed as follows according to the causative organism: *S. enteritidis*, 12 cases; *S. paratyphi*, 2 cases; *S. schottmülleri*, 5 cases; not definitely identified, 1 case.

Bahrenburg and Ecker,[1] in discussing the fatality rate, stated: "In the 20 cases classified in this report, all but 1 patient died—that of Lesnè. And in the 4 cases in which the organism was definitely established, all 4 patients died. Salmonella meningitis must, therefore, be considered fatal until more evidence to the contrary is produced."

The organism, now known as *Salmonella panama*, was first described by Jordan[2] in 1934 and by Kauffmann[3] in 1934. It was isolated by Jordan from the stools of 8 of a group of 40 American soldiers stationed at Fort Amador, Panama Canal Zone. Their illnesses were attributed to food poisoning. Jordan concluded: "Since this combination of agglutinative and cultural characters appears to be different from those of any Salmonella yet described, I venture to suggest for this organism the name *Salmonella panama*, of the subgroup, *S. enteritidis.*"

The 8 original strains isolated by Jordan were identical in all essential cultural and biochemical reactions. They were motile, gram-negative rods, producing acid and gas in dextrose, mannitol, sorbitol, rhamnose, maltose, xylose, arabinose, and trehalose. Gelatin was not liquefied and indole was not produced. Lactose, saccharose, inosite and salicin were not fermented. Two of the 8 strains produced gas in dulcitol. All of the 8 strains produced hydrogen sulfide and gave acid reactions in Jordan and Harmon tartrate medium.

Our organism gave biochemical reactions which agreed essentially with the above, but since they are reactions similar to those exhibited by *Salmonella enteritidis* and other closely related organisms, the serologic identification of this species is more conclusive.

Schiff[4] in December, 1938, identified *S. panama* as the cause of a serious type of infectious diarrhea in infants in New York City. His report was the first description of the recovery of the organism from patients in the United States. During 1936, 1937, and 1938, he isolated *S. panama* from the stools or blood of 4 of 5 patients suffering from diarrhea. It is of special interest that all of his patients were infants, aged 4 weeks (3 cases), 11 months, and 5 months. Two of the 5 infants died.

We believe that Schiff made an important contribution in calling attention to the occurrence of this recently recognized organism in New York City and reiterate his contention that more detailed study of the "atypical Salmonella types" of organisms isolated particularly from the stools in diarrheal diseases of the young infant should be encouraged.

It seems probable that our case is the first recognized instance of meningitis due to *Salmonella panama*. Since the organism was also recovered from the stools and from the blood, the mechanism of infection of the central nervous system is obvious.

It is difficult to assess the therapeutic effect of sulfapyridine in our case. It can only be stressed that the patient recovered from the initial attack and from a recurrent attack while the drug was being administered. It may even be well to reserve the opinion that complete recovery has occurred since it is well known that meningitis may become recurrent after long intervals of months or even years. However, since the mortality rate of Salmonella meningitis is so high, it seems significant that the child is now normal eight months after the primary attack.

To test the protective power of sulfapyridine against experimental infection with the Rochester strain, the following experiment was carried out: Two groups (40 each) of 6-week-old Swiss mice were inoculated intraperitoneally with a broth suspension of the organism. Each mouse received 0.25 c.c. of a 24-hour growth in Douglas broth. Each mouse in group A was then given 30 mg. of sulfapyridine in 3 doses of 10 mg. each. The drug was prepared for administration by grinding 1 gm. to a powder and suspending it in 50 c.c. of distilled water. Treatment was carried out by instilling 0.5 c.c. (10 mg. of sulfapyridine) of this suspension into the esophagus through a dull-tipped, bent 20-gauge needle from a 2 c.c. syringe. Each of the treated group received 3 doses: The first, immediately after inoculation with the organism; the second, 6 hours later; and the third, 16 hours after infection. The control group B received 0.5 c.c. of water at each treatment.

At the end of twenty-four hours, 24 of the 40 treated mice and 9 of the 37 control mice (3 of these were accidentally killed during the first treatment) were alive. At the end of one week, 15 of the treated group and 9 of the controls had survived. While the difference in the survival rates of the 2 groups at the end of 24 hours is statistically significant, at the end of 7 days, it is not. This may be due to the fact that the treatment was not continued.

SUMMARY

A case of purulent meningitis due to *Salmonella panama* in an infant is reported. We believe it to be the first recognized instance of this organism as the causative agent in meningitis. The patient recovered from a second attack. Therapy consisted of repeated lumbar punctures, blood transfusions, and the administration of sulfapyridine.

REFERENCES

1. Bahrenburg, J. H., and Ecker, E. E.: J. Infect. Dis. **60:** 81, 1937.
2. Jordan, E. O.: J. Infect. Dis. **55:** 224, 1934.
3. Kauffmann, F.: Zentralbl. f. Bakt., 1 Abt., orig. **132:** 160, 1934.
4. Schiff, F.: J. A. M. A. **111:** 2458, 1938.

ATAXIA DUE TO BITE OF AMERICAN DOG TICK (DERMACENTOR VARIABILIS SAY)

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THAT the bite of a tick can cause an illness in human beings simulating a widespread neurological condition is not generally appreciated. We are familiar with the role of ticks in the transmission of spotted fever, tularemia, and relapsing fever, but that they can cause a widespread flaccid paralysis, at times confused with poliomyelitis, or peripheral neuritis, is not as well known as it should be. The subject just recently came to my attention, and I have been unable to find anything but casual reference to it in many of the pediatric textbooks. There is an abundance of literature on the subject, very thorough and illuminating. McCornack[1] in 1921 reported a number of cases, tracing some back as early as 1905. He reviewed the literature and exhorted the profession to bear the condition in mind. In 1937 Barnett[2] made a similar plea. Up to the time of Barnett's writing, only the wood ticks had been reported as causing the disease in human beings, though these as well as other species had been accused of causing a similar condition in the young of sheep, dogs, and cattle. Of the hitherto reported cases in human beings in this country, all had been located in the Rocky Mountain states of Montana, Idaho, Washington, Oregon, and Wyoming—that is, regions in which the wood tick, *Dermacentor andersoni Stiles*, is indigenous.

In recent months the subject has taken on new meaning, by virtue of two separate reports of cases caused by the common dog tick, *Dermacentor variabilis Say*. One case was reported from Columbia, S. C., by Gibbes[3] and another from Augusta, Ga., by Robinow and Carrol.[4] The present report, from the same region, constitutes a third case. The dog tick has a more general distribution[5] than the wood tick, having been recovered in all the states east of the Rocky Mountains as well as the California coast, with the heaviest distribution probably along the Atlantic seaboard. The importance of this fact is apparent to all.

N. B., a white girl of 7 years, was seen at home at 10:30 A.M. on June 6, 1939. She gave a history of being cranky and irritable the day before, and her mother gave her a laxative at bedtime. During the night she fell out of bed. She did not seem to strike her head or injure herself at the time. She cried a little, then went back to sleep. On awakening this morning she complained of dizziness and a peculiar feeling in her hands. She said her hands felt lumpy and tingled. On getting out of bed, she wobbled badly, like a drunken man, and would have fallen had the parents not caught her. She could not dress herself. After this was done for her and she was carried to the breakfast table, she was so awkward about eating, she had to be fed. However, she ate a good breakfast.

On physical examination, her temperature was 98.4° F. orally, pulse, 76. She appeared comfortable and responded to questions, simply saying she felt funny when she tried to stand and that her hands felt peculiar. Ears, eyes, nose and throat were negative. Lungs, heart, and abdomen were negative. The knee kicks were absent, but she could move her arms and legs. Heel-to-knee, and finger-to-nose tests showed incoordination. There was no stiffness of the neck, and the Kernig sign was absent. On standing she swayed noticeably. Romberg's sign was positive. When walking she spread her legs wide, would bend the knees, and progress drunkenly. On examining her head for evidence of injury, a half engorged, female, dog tick was found imbedded in the top of the scalp. This was removed forcibly, causing the scalp to bleed.* No sign of injury to skull was found.

The child was seen again on the same date at 7:30 P.M. Temperature 98.8° F. orally. Pulse was 80. She could now walk without falling but still wobbled. Romberg's sign was now negative, though she swayed perceptibly. The knee kicks could be elicited. She said the peculiar sensation in her hands had disappeared.

She was seen again the following morning when her physical examination was negative, although she was still uncertain walking. She had slept well each night. She was not seen again but her father reported on June 13 that she was all right except for some swaying on climbing stairs. On June 14 her mother reported she appeared to be entirely normal.

An interesting side light on this case is the fact that there was at the time a local infantile paralysis scare.

DISCUSSION

From the literature one learns that laboratory evidence suggests the disease to be due to a venom elaborated in the developing ova of an impregnated female tick. It does not appear to be an infection. It is not caused by the male of the species. Cases thus far, with a few exceptions, have been in children or in immature animals. The offending ticks are most often found in the scalp, though sometimes along the spine, in the axilla, on the temporal region, or behind the ear—places where they might escape detection and remain throughout the incubation period, which appears to be from six to eight days. Though numerous deaths have been reported, all in children, there have been no autopsy reports.

Clinically, there is striking similarity in all the cases. The onset is usually sudden and progresses rapidly, even to death unless the cause is removed. Fever is usually absent. There may be irritability and fatigue for a day or two, preceding the onset of sudden inability to walk. The patients from the beginning are severely ataxic, and there is marked asynergia. Paresthesia is common. The ataxia appears to be due to both muscle weakness and incoordination. The weakness extends to complete, flaccid paralysis, at times even in a few hours. The paralysis begins usually in the legs and extends upward, involving the trunk, arms, muscles of deglutition, and speech. Death occurs from respiratory paralysis. When the tick is removed recovery is dramatic and usually complete in three or four days.

*The tick was identified by Dr. Joseph Krafka, Medical Department University of Georgia, and Dr. E. H. Ewing, Division Insect Identification, Department of Agriculture, Washington, D. C., as an adult, female, dog tick, *Dermacentor variabilis Say.*

After inquiry, the writer learned that the south Georgia negroes are so familiar with this syndrome that, whenever their children or domestic animals display these symptoms, they search at once for ticks on their bodies.

CONCLUSIONS

1. A case is reported of generalized ataxia and asynergia, with recovery, resulting from the bite of a female common dog tick, *Dermacentor variabilis Say*.

2. The importance of such cases to the pediatrist is apparent when one finds that most of the reported cases have occurred in children, and it would seem, may occur anywhere in the United States. To one unfamiliar with the syndrome, it could easily be confused with polioencephalitis.

REFERENCES

1. McCornack, P. D.: J. A. M. A. **77:** 260, 1921.
2. Barnett, E. J.: J. A. M. A. **109:** 846, 1937.
3. Gibbes, J. H.: J. A. M. A. **111:** 1008, 1938.
4. Robinow, M., and Carrol, T. B.: J. A. M. A. **111:** 1093, 1938.
5. Bishop, F. C., and Smith, C. N.: Circular No. 478, United States Department of Agriculture, April, 1938.

1211 GREENE STREET

PSYCHOLOGIC CARE OF THE PRESCHOOL CHILD

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PART I

I. Principles underlying psychologic care
II. Psychologic maturation
  A. The emotions
    Self-dependence
    Aggression
    Negativism
    Insecurity
    Fear
  B. Intelligence
    Mental testing
    The language functions
      Lateral dominance
      Speech
  C. Play
    Imaginary playmates
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IN A RECENT paper a program for psychologic care during infancy, suitable for office practice by the pediatrician, was outlined.[1] Emphasis was placed especially on preventive care, and it is the purpose of this paper to present a further program for use during the preschool period.

The principles underlying psychologic care during infancy retain their validity in childhood and may be restated here, since an appreciation of these fundamental concepts is essential if proper care is to be given.[2]

I. PRINCIPLES UNDERLYING PSYCHOLOGIC CARE

We wish to emphasize at the outset the identity of principles on which both physical and psychologic care are based. The child, like the adult, is an integrated unit, and due consideration must be given to the child's skills, thoughts, and feelings as well as to his physical being.

In the psychologic, as in the physical sphere, development or maturation proceeds according to a plan and a sequence which is innate and which is not susceptible, in significant degree, to environmental influence.[3] Once the child has matured to a developmental phase, behavior within that phase may be improved and extended through a process of training; but a developmental phase cannot be initiated except under highly artificial circumstances. An attempt to accelerate

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the maturation sequence (i.e., demanding of the child more than he is capable of doing) is not only useless but may actually be harmful. Parental disappointment at the child's failure leads to a strained atmosphere between parent and child and to various disturbances in the child.

The unfolding of the psychologic maturation sequence, like the physical, is obligatory and not optional, and the developing potentialities and feelings of the child represent psychologic needs analogous to the nutritional needs. Among the psychologic needs of the child may be mentioned affection, attention, applause, play, motor activity, speech, self-dependence, aggression.

The maturation process implies the relinquishing of outgrown modes of behavior as well as the acquisition of new patterns. Difficulties in child training arise from attempts at retardation as well as acceleration.

Disturbances in behavior should be looked upon as symptomatic of interference with the developmental plan, as failure to gratify the psychologic needs, or as manifestations of overindulging the psychologic needs. It is our belief that psychologic disorders and the associated personality defects are in most instances curable if the etiologic mechanism can be detected and removed. Children who habitually misbehave are as much the victims of improper care as are rachitic, anemic, undernourished, or obese children. From the point of view of the pediatrician, they should not be considered as "bad" children, but rather as patients in need of therapy. Proper psychologic care is important for the child in the same way as is proper nutritional care.

II. PSYCHOLOGIC MATURATION

A. EMOTIONS

SELF-DEPENDENCE

The infant passes quickly through the stage of almost complete dependence and at 3 to 4 months he is already interesting himself in his environment, vocalizing, looking about, studying his extremities, developing his motor skills, and smiling as well as crying. As he approaches the end of his first year he enters a critical phase in his development. Unfortunately this is the age at which visits to the pediatrician ordinarily diminish in frequency. The child is on a practically complete diet, he has received his prophylactic inoculations, and it will be some years before the contagious diseases will make their appearance.

The developmental phase to which we refer is that in which self-dependence appears. It is the period in which the child, literally and figuratively, tries to stand on his own feet. The child, formerly content to have his bottle held for him, now starts to make efforts to support it himself. He lifts himself up, moves about his crib or play pen, and starts to explore his environment. He begins to indicate a desire for elimination and tries to assist at dressing and undressing. As he

learns to walk he continues his explorations and very soon tries to control as well as investigate his environment.

An atmosphere of affectionate encouragement is essential for the proper handling of this developmental phase. Spontaneous efforts of the child toward eating utensils, bowel and bladder control, etc., should be watched for and made use of in training by the parents, but attempts to initiate such efforts are ordinarily not necessary and should not be undertaken without due consideration of the child's earlier training. The pleasure which the child derives from achievement should be utilized by the parent to instill habits of cleanliness, neatness and helpfulness. Children who fail to receive the affection and encouragement which they need during this period experience a sense of defeat and ordinarily respond with passive behavior and submission.

The most common parental error during the phase of emerging self-dependence is overprotection. It is apparent that, where the parent insists on feeding the child, on dressing and undressing him, protecting him lest he fall and hurt himself, there will be a delay in the acquisition of behavior for which the child is developmentally ready. The overprotective attitude does not usually extend to micturition and defecation; indeed training in these functions is often prematurely attempted. The overprotected child ordinarily accepts the parental attitude and responds with immature behavior.

Parental overauthority interferes with the development of self-dependence by attempting to impose a plan of action which may be in opposition to that of the child. An overcritical or an overcorrective attitude or too many prohibitions are also harmful. Excessive parental demands may stimulate the child's negativism and make him resistant to learning procedures. They may lead to an atmosphere of strain between parent and child and give rise to feelings of inadequacy, defeat, and anxiety in the child. Parents must be taught to temper their eagerness and await patiently the acquisition of various skills by the child.

Excessive parental applause is also to be discouraged since it may instill in the child a sense of importance regarding his activities which they do not deserve. At a later period (i.e., during the third year of life), when various skills become well established and habitual, the child must learn to rely less on parental applause and more on his own inner satisfaction in achievement.

AGGRESSION

Aggressive behavior is an expression of the child's desire to carry out his own plan of action. Though already evident early in infancy, aggressiveness becomes prominent in the transition period between the more or less passive dependence of infancy and the relative independence of childhood. If not excessive, it is a desirable form of behavior and when properly directed it becomes an asset to the individual and a constructive force in society.

Excessive aggression is most frequently seen as a response to parental overindulgence, to rejection with overprotection, and to overauthority. It is seen where there is parental incompatibility, especially where the son, siding with the mother, is antagonistic toward the father.

The aggressive child attempts to dominate every situation and may resort to screaming and temper tantrums to attain his objective. Frequently the parent finds it easier to comply with the child's demands than to have a scene. If the child succeeds, the same technique will be repeated. The temper tantrum is one of the common manifestations of aggressiveness during the first 4 years of life. The child lies on the floor, kicks and screams, often holding the breath until cyanosis appears. Convulsive twitchings may be associated with the cyanosis.

Some children are unduly aggressive at home but shy and reticent with strangers. These are usually overindulged children who know that they can have their way with their parents but who have not been given enough responsibility to know how to conduct themselves in a strange environment.

Correction of the unfavorable home environment is essential as the first step in treatment. The child should be shown the undesirability of asocial behavior and the advantages of social behavior. The temper tantrum may be ignored as it is primarily an attention-getting mechanism, and instead the child should receive sufficient applause for desirable conduct. Giving more responsibility and helping the child to grow up are valuable aids in treatment. Where aggressiveness is accompanied by brutality, an outlet may be provided in play activities such as hammering, cutting, pounding, etc.

NEGATIVISM

Negativism is an expression of the child's resistance to attempts by others to impose a plan of action upon him. It is most highly developed toward the end of the second year and usually decreases in intensity during the fourth year of life. If it persists undiminished after this age the psychologic environment should be investigated. Excessive negativism is most frequently seen where the parents are overauthoritative, overcritical, or overcorrective.

The negativistic child takes every opportunity to refuse what is requested and in many instances refuses when he really would prefer to comply. An approach not uncommonly used by parents who find that the child responds negativistically is to ask the opposite of what they desire as, for example, "Don't wash yourself before lunch," or "Don't eat your vegetable." This method is to be condemned since it merely confuses the child who fails to comprehend the parental subtleties.

Dawdling is a form of negativistic behavior and is most commonly seen in the children of overauthoritative parents. Fearing to resist

openly, the dawdling child complies with parental requests slowly and unwillingly. Such children are slow at eating, dressing, washing, etc.

With the negativistic child requests should be so phrased that there is a minimum of opportunity to refuse. Often the situation may be arranged in such a way that the child actually wishes to do what the parent desires. The attitude of parent toward child should be investigated and modified where necessary. Nagging and coaxing should be eliminated and overauthoritative, overcritical, overcorrective attitudes should be discouraged.

INSECURITY

A feeling of insecurity arises most commonly in young children as a result of parental indifference or rejection. It is also seen where the overprotected, overindulged child is required to meet strange adults or children. Other etiological factors at this age are appreciation by the child that he has a physical defect or undesirable habit, and parental incompatibility.

Insecurity usually manifests itself in the young child as shyness, reticence, and uncertainty. The child is unhappy, cries easily, and readily shows feelings of shame and guilt. In the rejected child, where the need for affection is not gratified, there may be excessive demands for attention or vengeful conduct.

The child's need for affection should be explained to the parents and the home situation modified as far as possible.

Physical Defect.—The presence of a physical defect frequently leads to feelings of inferiority and insecurity. Children prefer to look and dress like their playmates and any deviation from the usual is likely to lead to unhappiness. The desire to conform does not ordinarily appear until school age, but where there is a physical defect this desire may manifest itself earlier.

Children are apt to be unkind to one another, and the parents of a child with a deformity should make every effort to keep him from feeling inferior. If possible, the defect should be corrected by three or four years, before the child is aware of the deviation. If it is necessary to wait until a later age, the child should be assured that the defect will be corrected at the proper time.

The child with an irreparable defect should be taught to face the world and to live openly with the defect. He may be told that his deformity is regrettable but certainly nothing to be ashamed of, that there are other things about him which compensate, that, as it cannot be cured, it must be borne as others bear other difficulties. Occasionally, the defect may be capitalized, e.g., that glasses are becoming, left-handedness is an asset in pitching and batting, a famous athlete is red-headed, etc. Furthermore, in many cases the unimportance of the defect may be pointed out so that the child may rise above it, gain confidence and with

this confidence either overcome the difficulty or ignore the teasing, which quickly stops when it no longer hurts.

FEAR

According to Watson,[4] the newborn infant shows fear in response to only two stimuli, loud sounds and loss of support. Watson believes that fearful responses to other situations in later life arise through a process of conditioning. This viewpoint is not generally accepted. Gesell[5] and others[6] believe that conditioning plays only a minor role and that the larger number of stimuli which elicit fear as the child grows older is dependent on the maturation process and the child's widening experience.

During infancy children's fears are aroused by the immediate properties of stimuli that impinge upon them. Suddenness and unexpectedness are present in all fear-exciting situations.[7] Between 2 and 5 years there is a sharp decline in the frequency of fear responses to concrete stimuli, such as noise, strange objects, and falling, and an increase in fears of imagined, anticipated, and supernatural dangers.

When fear results from undesirable conditioning, as, for example, the child's fear of the bath tub because at one time he has slipped and fallen, unconditioning should be undertaken as soon as the effect is recognized. This should be done slowly, persistently and with an attitude which will help the child to feel assured and secure.

The stimuli which elicit fear may be divided into two groups, objective, i.e., fear of things which may be seen, heard or felt, and subjective, which are based on the feelings and attitudes of the child toward something he has heard or imagined and on which he has brooded. The young child probably fears any novel or unexpected stimulus with which he is unable to cope and for which he has no adequate response. Fear, with no means of flight or escape, may arouse anger.

Perhaps the commonest childhood fear is that of the dark. The child at bedtime is isolated. Since he cannot be distracted by the familiar objects in the room because of the darkness, he must rely on his own feelings and thoughts. The child should not be forced to face the dark nor should he be scolded and made to fear parental contempt, since this simply adds another fear. It is wiser to applaud his courage in other fields rather than to remind him of his failure in this one.

Young children are often afraid of the water, but, with experience and growing mastery, they learn to enjoy it. If a child is exposed often enough, in reassuring company and under safeguards sufficient to give him a sense of assurance, fear usually gives way to pleasure in a newly found activity.

Another fear is that of being "lost" or being deserted by the parent. This is most common in the insecure child but is found in all children who have not been given a reasonable amount of responsibility. A

reassuring word, even from a stranger, may prevent a lasting, unpleasant effect on the child. Exaggerated fearfulness is characteristic of the insecure child.

B. INTELLIGENCE

Intelligence testing during the preschool period should be discouraged except where a specific indication exists. There is no more justification for determining the intelligence quotient in a normal child than in estimating the basal metabolic rate, and there are disadvantages. A numerical rating of intelligence in young children is inaccurate. By permitting seemingly precise comparisons, it encourages an attitude of competition among mothers and leads to needless parental concern, disappointment, and anxiety.

There are, however, occasional instances of doubtful intelligence where testing is indicated. It is therefore important that the physician should familiarize himself with the uses and limitations of this technique. He should be able to interpret the results of the tests in a general way and understand their degree of reliability.

Norms for intelligence are based upon the child's ability to perform prescribed tests in a prescribed way at certain stated ages. Mental age indicates the level which has been reached in intellectual development as measured by the test used. The ratio of mental age (M.A.) to chronological age (C.A.) multiplied by 100 gives the intelligence quotient (I.Q.). Average intelligence is 100 by definition, which means that the mental age equals the chronological age. Intelligence is distributed in the population at large as a normal curve. Approximately 60 per cent of all individuals have intelligence quotients from 90 to 110 and so are grouped as normal or average. Another 14 per cent vary from 80 to 90 and may be grouped as slow and 14 per cent from 110 to 120 may be grouped as bright. An I.Q. between 70 and 80 indicates borderline deficiency and includes another 5 per cent of the population. The remaining 1 per cent of low intelligence individuals is feebleminded and includes morons, imbeciles, and idiots. Morons may be expected in adult life to attain a mental age of 8 to 10 years, imbeciles of 3 to 7 years while idiots rarely go beyond 2 years. At the upper end of the scale an I.Q. of 120 to 130 is considered superior intelligence and includes about 5 per cent of the population, and the 1 per cent falling above an I.Q. of 130 is very superior. It is rare to find an I.Q. score above 150.

The number of feebleminded in the general population depends upon where the line of demarcation between normal and feebleminded is drawn. At present an I.Q. of 70 may be considered the dividing point. There is no sharp division between the normal and the feebleminded as far as performance on intelligence tests goes, but a gradual progression from one to the other. The I.Q. of a particular individual usually

maintains a fair degree of constancy throughout the period of mental development but as maturity is approached it loses much of its significance.

MENTAL TESTING

Intelligence tests do not measure pure native capacity for intellectual development, but indicate the immediate efficiency of the individual in certain specific respects. The results of all mental and educational tests are relative, i.e., the score which the child makes has significance only by comparison with the scores of other children on the same tests. The score serves as an indication of the rank of the individual in a group in which he may be placed or with which he may be compared. What is being measured is the reaction of the innate endowment of the child to his training at the moment when he is being tested. The particular activities demanded of the individual being tested are selected from those which are likely to be common to the experience of all the persons who are to be compared. Or to put it another way, it is assumed that training and experience in the activities which are being tested are as nearly equal as possible among all the individuals.

Intelligence testing is of little value unless both the administration of the tests and the evaluation of the responses are carried out according to a carefully standardized technique. The physician therefore should be familiar with situations which affect the accuracy of the tests:

(1) Misinterpretation of the child's responses may invalidate the results of the test.

(2) Failure to secure wholehearted cooperation of the child being tested, that is, inability to establish satisfactory rapport, decreases the score.

(3) Coaching and practice increase the score in intelligent children.

Gesell[8] gives a list of simplified behavior items for preschool children which the physician can use in conjunction with his clinical judgment in determining the developmental progress of the child.

The test most frequently used at the present time is the 1916 Stanford revision of the Binet test.[9] This covers the age range from 3 years to superior adulthood and is particularly reliable for children between 6 and 12 years. The probable error at 6 years is about 3 months and at 12 years about 6 months. It is scored as mental age and intelligence quotient. It is believed that this test is not greatly influenced by malnutrition, by loss of a few months at school, or by attendance at a nursery school. Cultural and environmental influence at home have only a slight effect.

In 1937 Terman and Merrill[10] published a revision of the Standford-Binet test which has a lower and higher range and has the advantage of being made of two alternate forms so that there is not the complication of coaching and practice effects if retesting is necessary.

The Gesell Development Inventories,[11] published in 1925, are an attempt to establish norms of mental and motor growth during the preschool period. No effort is made to measure general intelligence, but this group of tests gives a good idea of language, adaptive behavior, personal-social behavior and motor ability.

The Merrill-Palmer Performance Tests[12] have the advantage over most tests at this age level (2 to 5 years) in keeping the child interested. They do not require great language ability and have a high reliability. They are concerned for the most part with the ability of the child to perform manual tests.

LANGUAGE FUNCTIONS

Lateral Dominance.—Hand preference usually becomes established during the second year of life. About one out of every six in the population is left-handed. Once established, no attempt should be made to convert the child to right-handedness. With definitely left-handed children there is little chance of confusion as they are so much more adept with the left hand that they refuse to be changed. This is not the case with ambidextrous children or with children who have only slight preference for one hand. The latter may be converted without their or the parents' realizing that this has taken place and it then becomes difficult to determine if these children were actually left-handed.

Tests for lateral dominance are complicated by two factors, the absence of clear-cut preferences for one or the other side of the body by certain individuals, and, second, the influence of training procedures on left-handedness.

Since left-handedness is hereditary, a family history is of some value. Inquiry should be made regarding early hand preference and any attempt at conversion. Of importance also is a history of delay in the choice of a master hand and undue clumsiness in learning to button clothes, tie shoe strings, ets. The choice of hand for such activities as drawing, eating, ball-throwing should be investigated.

The diagnosis of left-handedness may be aided by giving certain tests such as ball throwing, both overarm and underarm, and hammering and fitting pegs into holes.

By *eyedness* is meant the selection of the eye which is habitually used for sighting.[13] The eye is less often subjected to training procedures than the hand. It has been suggested that the sighting eye determines the master hand and that left-eyed individuals who are right-handed are converted sinistrals. Orton[13] disagrees with this view and points out that this hypothesis fails to explain the occurrence of right-eyedness in certain left-handed individuals. Evidence against this viewpoint is also offered by Ballard,[14] who states that there is the same proportion of right- and left-handedness among the congenitally blind as among the seeing. The simplest test for eyedness is performed as follows: A hole

about one-half inch in diameter is made in a stiff piece of paper. The paper is handed to the child and he is requested to look at the examiner's finger or other object through the hole. The child will usually use the master eye for this purpose. The paper may be placed in the patient's right hand, then in the left hand, and finally in both hands. Several trials should be made each time. In most instances this test will reveal a definite preference for one or the other eye. In some instances, however, the child will use the right eye when the paper is held in the right hand, the left eye when the paper is held in the left hand, and will show indecision when the paper is placed in both hands, indicating that there is no decided eye preference.

Defects in vision have little influence on the choice of the master eye unless the refractive error is considerable. According to Orton, sighting is dependent on the skill of the extraocular muscles rather than on clarity of vision.

Footedness like eyedness is much less likely to be influenced by training than handedness and hence the determination of footedness may be of some value. The preferred foot is used for kicking, hopping, and for starting up a flight of stairs, etc.

Once hand preference is definitely established, no attempt should be made to change it. Left-handedness has no serious disadvantages except that we live in a right-handed world and many implements are made to be used with the right hand such as scissors, tools, chairs with arm for writing. In addition, there are occasional social disadvantages.

There are several reasons for not attempting to convert a child. The child will usually be less successful with the right hand in such activities as writing, playing games, and using tools if he is actually left-handed, and this may cause him to feel inferior and dissatisfied with his achievement. The conversion may cause confusion, as shown by the frequency of disturbances in the language functions, speaking, reading, and writing. There may be accompanying hyperactivity and uncertainty.

SPEECH

The age of appearance of true speech, by which is meant the ability to use words with meaning, varies widely. The child is able to understand the language of others long before he himself has acquired true speech. The ability to use even one word with meaning is rare before the tenth month. By one year about 74 per cent of children have begun articulate speech.[15] Even at 18 months McCarthy[16] found that only 26 per cent of the vocal responses of the 20 children she studied were comprehensible. By 2 years the normal child may be expected to have a vocabulary ranging from 20 to 300 words.

Children during this period are very imitative. The fact that the normal child learns with equal facility any language to which he is exposed is good proof that this imitativeness plays an important part in the acquisition of speech.

Almost without exception, nouns having concrete meaning are the earliest words used, names of familiar objects or persons being most frequent. The infant prefers monosyllables or disyllables showing duplication, e.g., bye-bye, tick-tick. Verbs and pronouns then come into use, and the early sentences of the child appear as direct repetitions of combinations of words previously heard. Later, relative pronouns and coordinating and connecting words are used, and gradually words with abstract meaning appear.

Of the factors influencing language development, socio-economic status is one of the most important, children from better environments being consistently more advanced than poor children; in fact, environmental conditions correlate more closely with language development than with intelligence test results. Intelligence seems to be related to speech development, gifted children starting to talk, on the average, about 4 months earlier than average children, but it is not clear whether the precocious development of language is due to greater intellectual endowment or whether the higher scores on the intelligence tests are due to the greater linguistic ability.

Twins tend to be retarded in language ability. This does not appear to be dependent on inferior intelligence. It may be due to the close companionship between twins, who are on the same linguistic plane, to the exclusion of other more advanced children from whom they might learn. Association with adults leads to precocious speech development. Late acquisition of speech may be familial. Sex is also of importance, girls being more advanced in speech development than boys.

RETARDATION IN SPEECH DEVELOPMENT

Children who are unable to use at least 12 words with meaning by the third birthday may be looked upon as pathologically retarded in speech development. This may be due to mental retardation, organic disease of the brain, deafness, dumbness, lack of opportunity for learning, or parental oversolicitude. Left-handed individuals are particularly prone to disorders of the speech mechanism. Since retardation of speech may be due to an organic condition, a careful examination of the child should be made.

Mentally retarded children (I.Q. below 70) are delayed in acquiring speech, and this delay becomes more marked as the mental defect increases. All forms of speech defect except stuttering are more common in this group than among normal children. Indistinct articulation is the most frequent. Defective children often show no understanding of the question-response situation but imitate words and inflections which they hear, a condition known as echolalia. Mutism is frequent in idiots and can be ascribed to the severe degree of mental deficiency or to injury to the brain.

Any organic disease of the brain affecting intellectual development may lead to retardation of speech in children. Encephalitis is particularly prone to affect the speech centers, and children previously able to talk may speak in a mumble difficult to understand or may be mute.

Disturbance in hearing is a not uncommon cause of retardation of speech in children. If the hearing disturbance is present before speech has developed, mutism results. Deafness, even though incomplete, usually results in more or less complete loss of speech if acquired before the end of the fifth year. In older children deafness does not abolish speech, but the voice is usually harsh and monotonous.

Parental Oversolicitude.—A great handicap in the development of speech is a home where the child's slightest whim is anticipated and gratified by the oversolicitous parents. The child needs only to point to an object or scream, and his wants are gratified. Under these circumstances there is little need for speech. Furthermore as a result of parental efforts at protecting the child against injury, motor development and muscular coordination obtained in such activities as crawling and walking may be inhibited. Speech is acquired only through the harmonious action of brain and muscle, and there is frequently a delay in speech or a weakened speech mechanism where other forms of poor coordination are found.

Lack of Opportunity for Speech.—In orphan asylums or hospitals where there is lack of opportunity for speech or little interest in what the child says, speech may be considerably delayed and when acquired may continue for an unusually long period to be of the infantile type.

DISTURBANCES OF SPEECH

Speech defects include lisping, stammering or stuttering, monotonous voice, and indistinct speech.

Lisping, commonly referred to as "baby talk," is normal in the young child and usually disappears at 4 or 5 years. Ordinarily there is substitution of *th* for *s,* but there may also be other substitutions, especially *w* for *r.* If allowed to persist, it may develop into an annoying habit with difficultly understandable speech and secondary emotional disturbances. Lisping may be caused by a physical defect such as harelip, tongue tie, or palatal deformity. In such instances speech training is necessary after operation unless the deformity is corrected early in life. Lisping is most frequently observed in overprotected children who are babied by their parents. By adjusting the parent-child relationship and helping the child to accept a more mature role, the habit will usually disappear. Lisping may be due to faulty training in early childhood. When the child begins to form words, many parents, finding the imperfect speech pleasing, imitate the childish efforts, thereby preventing the child from hearing and acquiring normal enunciation. Furthermore, children, being eager for applause, will persist

in a pattern of speech which is appreciated. Children may also acquire a lisp when the parents, because of lack of education, carelessness, or foreign birth, speak imperfectly.

Stuttering or *stammering* manifests itself by a series of repetitions of the first letter or two letters of a word. These occur at varying intervals and with great irregularity. At times a word spoken with great difficulty can be enunciated correctly soon afterward. Stuttering ordinarily begins between the second and fourth years of life when speech is developing rapidly. The onset is usually gradual and may pass unnoticed in young children.

Cobb and Cole[17] divide the schools of thought regarding the causes of stuttering into three categories:

1. According to the older physicians, stuttering was looked upon as a disturbance of the peripheral speech mechanism and much of the therapy, currently practiced with some success, is based on this hypothesis.

2. According to the psychologic school, stuttering is considered as a disorder of the personality. The disturbed speech is a symptom of an underlying conflict and is the result of fear or lack of confidence.

3. According to the third point of view, stuttering is a disturbance of the language functions, which include not only producing and understanding speech, but also reading and writing. That these processes are closely associated is shown by studies of aphasia, where the whole language function or any part of it may be disturbed, and areas in the brain have been demonstrated which regulate these functions. These areas exist mainly in one side of the brain; the other side is not essential for the language functions.

Although stuttering may be solely psychologic in origin, it is likely that in many instances there is a structural abnormality in the brain. Persons with such an abnormality in the language centers, when exposed to emotional stress, are much more likely to develop speech defects than are structurally normal individuals. Frequently associated with the speech defect are difficulties in reading, writing, and other motor skills.

Stuttering is often hereditary, occurring in several generations. It may also be imitative.

In the treatment of stutterers a careful history and examination are necessary in order to determine whether the defect is primarily psychologic or neurologic. Where there is a history of speech defects or left-handedness in the family; or where the stutterer was trained away from the master hand or is ambidextrous, a neurological basis is probable. In such instances, if the child is young enough, allowing free choice of the master hand may be curative. At a later age, special training procedures are necessary. In all cases, whether primarily psychologic or neurological, an effort should be made to relieve psychologic strain.

Monotonous voice is an inhibition in the field of inflection and is frequently due to partial deafness in the child. Occasionally it is caused by imitation or by faulty training. *Indistinct speech* occurs more often in boys than girls and results from carelessness in pronunciation or from poor training. It occurs most often in the child who is careless in other respects.

Incessant talking is most common at 3 or 4 years of age when the child has more to say than he is able to say or than the parent is willing to listen to. Silence should not be enforced as this period closely precedes the usual period of inquisitiveness and questions, which the child should feel free to ask. If carried beyond the endurance of the parent, the child may sometimes be diverted by substitution of some other form of motor activity for speech. If incessant talking continues into the school age, it may be a compensation for timidity or a feeling of inadequacy, and the environmental cause should be investigated and corrected. It is frequently associated with other forms of hypermotility.

C. PLAY

Play is one of the fundamental needs of the child. It provides an outlet for his energies and fantasies, permitting him to develop his muscles and skills as well as his imagination and inventive powers.

Quiet play is desirable under 2 years, but thereafter more energetic play may be permitted if the child enjoys it. The child under 3 years prefers to play by himself but in the presence of others. His interest is mainly in exploration and manipulation. He enjoys pushing or pulling objects about or lining them up as "parades." Since almost any object serves equally well for this purpose, elaborate or expensive toys are unnecessary. He should play as much as possible without adult interference so that he may develop initiative and self-assurance.

Toys should be put away when the child is finished with them. From 18 months to 3 years children are naturally orderly and this age period may be utilized to instill habits of neatness. The child may be made to understand that, if he puts his toys away, he will find them again more easily and also that when the toys he is not using are put in place, there is more space for him to play.

After the age of 3 years the child begins to show an interest in people. As long as another child does not take toys from him, he is willing to play with him, but taking turns or waiting for turns is difficult. Situations occur when children play together that could not take place if the child played alone or with an adult. If he wants something, he uses force to get it. There is likely to be considerable crying, and it is often necessary for an adult to interfere in order to avoid difficulties. Proper adult guidance at this age may be very helpful in acquainting the child with the social experiences which make life easier. Although children under 4 may take part in a loose form of cooperative play

such as hide and seek and ball playing, each member is still an individual and carries on his own play as such.

Children during this period should be encouraged in play which develops the larger muscles, like climbing, swinging, and tricycle riding. Play with large blocks and boxes, pushing about of large toys on wheels and play with water, clay and finger paints are enjoyed by children of this age. During the preschool period opportunity to use a great variety of materials is more important than practice at one thing.

From 3 to 4 years an interest in stories and songs develops as the child gains in ability to repeat part of what is told him and sometimes to elaborate upon it. Running, marching, and skipping to music is enjoyed. As the child grows older, he shows interest in looking at pictures and hearing stories about other children, animals, and everyday happenings. The young child likes repetition and prefers to have the same books read over and over again.

After 4 years children enjoy games or dramatizations which assign parts to certain individuals. Dressing up and pretending are very popular at this age, and most children of 4 and 5 and even older love "costumes." There is greater interest in organized play, and some equipment is desirable. The young child is frank and honest, and most games are played out in fairness, disputes arising only over possession of a toy or over the child's desire to represent some object or person which the other child wishes to represent. At this stage leaders begin to develop, although until school age there is a good deal of shifting back and forth.

Mechanical toys are undesirable since they deprive the child of his power to conduct the imaginative activity himself. Throughout the preschool period boys and girls play together without differentiation.

IMAGINARY PLAYMATES

Young children not infrequently have "imaginary playmates" who share all pleasures and sorrows with them. These companions can be described and talked to, and they often embody qualities which the child would like to possess. They occupy space and can be hurt both mentally and physically. They are treated in all respects as actual companions, but almost invariably, upon questioning, the child realizes their unreality.

Only children, children in families where there is little companionship among the siblings, as well as frustrated and unhappy children often resort to imaginary playmates as an escape from dull or unpleasant reality. But it is by no means unusual to find one child, in a family of apparently satisfactory sibling relationship, who has an imaginary playmate. These children are usually of high intelligence.[18]

The resort to imaginary playmates is not abnormal and is merely the device of a vivid imagination to compensate for lack of satisfactory

companionship. The fancy should not be discouraged unless carried to an extreme in which case the best cure is the substitution of actual people and events for the make-believe companion. The child's life should be made more interesting and friendships encouraged. The parents should seek out the need which the child feels and attempt to fulfill this or compensate for it.

THE NURSERY SCHOOL

The aim of the nursery school is to give the young child an optimal opportunity for emotional and intellectual development. By means of play situations provided in the nursery school, children of 3 to 5 years acquire self-reliance and socialization with great facility. The aim of the progressive school is to assist the child to think through for himself the problems which are presented.

Advantages.—The nursery school is useful where the mother is employed away from home and hence is unable to supervise her children's care during the day. The staff is specially trained and is superior to housemaids and to the majority of nurses who care for children. The daily sessions are ordinarily short and leave ample time for the development of normal parent-child relationships. The school can only supplement home care and should not be expected to replace it.

The nursery school offers the child the opportunity to be with children of his own age, and it is therefore particularly valuable for the only child or for the child with no siblings near his age. It can also supply more and better play equipment than the home. A large choice of outdoor apparatus is desirable as it encourages exercise and the development of large muscle activity. Smaller muscle activity is developed through the use of hammer and nails, paints, and clay. A sense of accomplishment, so hard to establish in the small child, is readily developed in this way and along with it a sense of beauty of form, color, rhythm, etc.

Supervision and guidance are important in the constructive use of play materials, and for this purpose the specially trained teachers are particularly useful.

The overprotected child benefits through added responsibilities, through contacts with adults outside the home and by being a member of a group of children. It is not unusual to find that the child who is unhappy or misunderstood at home develops rapidly at the nursery school. Many children establish routine habits with greater ease when learned in a group. This is particularly true of eating, resting, and of putting away toys. Unselfishness and cooperation become a part of the daily routine.

Disadvantages.—The frequency of infections wherever children congregate in groups is a drawback. Furthermore some children, unaccustomed to a group, are overstimulated at school. There is a great

deal of running about and shouting at many nursery schools and too little rest. Even a half day session may be too long for some children and hyperactivity, irritability, sleeplessness, anorexia, and weight loss may result. Also, certain parents can give more to their children than any nursery school, and these children should, of course, be kept at home.

Some children definitely do not benefit by the nursery school. Each child should be studied individually and the type of nursery school, the personalities of the child and the parents, the most suitable age, the number of hours per day as well as the number of months or years that the child will remain should be considered.

The most frequent difficulties encountered in sending the child to nursery school are those due to his being separated from his home and are therefore more striking in the overprotected child. Crying at parting from the mother, nausea and vomiting, day wetting, refusal to play with other children, shyness, refusal of food, lack of cooperation, and various attention-getting mechanisms which may have been successfully avoided or handled at home sometimes occur, as well as temper tantrums, domineering attitudes, and especially disobedience. There is not as much supervision and direction at progressive nursery schools as in the conventional kindergarten, and therefore the timid, shy child sometimes has difficulty in making an adjustment.

(*To be continued.*)

Critical Review

INFANT RESUSCITATION

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HISTORY contains many reports of attempted resuscitation of the apparently dead. The earliest reference is that of the Bible in which Elisha brings back to life the son of a Shunamite woman by breathing into the mouth of the child.[1] In the early ages the methods consisted chiefly of physical or chemical shock and were characterized by violent manipulations of the hapless victims of asphyxia. Obviously, there was little knowledge of scientific essentials in diagnosis and treatment. The use of bellows for forcing air into the lungs was introduced by Paracelsus in 1530. John Hunter, 1776, improved this method by adding the withdrawing of the patient's exhaled breath.

The older textbooks of obstetrics devoted little space to the subject and commonly recommended Schultze's swinging method. This and similar methods of artificial respiration are suggested in many articles on newborn asphyxia in the foreign literature and a few American journals.[2, 3] Gauss, in 1938, listed and recommended no less than eight such methods. These include the one used at the Würzburg Clinic—"namely energetic rhythmic pounding with the fist on the left side of the thorax with the infant lying on the table: the beats must be in tempo with the infantile heart beats (sic) and the epiglottis must be pulled forth with the index finger of the other hand or else a tracheal catheter may be in situ."[4] Considerable evidence has been accumulated to prove that the quoted method and many others of the same type have caused severe trauma to the already weakened infant, and, moreover, there is no definite proof that they actually institute regular respiration. The only sound manipulative method that should survive is the Schaefer prone pressure method, but this is more readily applied to adults than to infants.

Cutaneous stimulation has been used for many years with the idea of transmitting afferent stimuli to the depressed respiratory center. This is of doubtful value. Stretching of the anus as advised by many writers is most likely also ineffective and has the added disadvantage of possible trauma.

Before 1929 one finds few references to asphyxia neonatorum and its treatment. The collected papers of so prolific a writer as Abraham

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Jacobi contain only three such references, and these are concerned with the frequent finding of birth asphyxia in the histories of definite mental defectives.[5] He pleads for early and effective treatment and shows that the longer the nonbreathing state exists, the greater the cerebral injury with its consequent mental retardation.

In the last decade many papers were written on every phase of the subject, including observations on fetal respiratory movements in utero, the incidence of asphyxia of the newborn, its experimental production in animals, the etiology, physiology, pathology and chemistry of the condition, and finally the various suggested methods of treatment. This great increase in the number of reports is due primarily to the greater volume of medical literature. In addition, statisticians have shown that although the death rate for the whole of infancy has been considerably reduced, the rate for the early hours and days of life has decreased only insignificantly. The many attempts to improve this situation have centered about the subject of neonatal asphyxia. The increased use of maternal sedatives, narcotics, and anesthetics in response to the popular demand for painless childbirth has caused a sharp rise in the incidence of nonbreathing newborn infants and, naturally, a more frequent need for resuscitation.[6-9]

The mechanism of asphyxia must be considered in order to have a clearer understanding of the principles of treatment. The work of Ahlfeld, Bonar,[10] Snyder[11] and others has definitely proved that the fetus makes rhythmical respiratory movements in utero. Bonar argued that "from a purely physiological viewpoint, it would seem somewhat unreasonable, after all, to assume that the fetal respiratory tract remains inert in utero, awaiting some stimulus to initiate its hitherto unpracticed respiratory mechanism at birth, while the cardiovascular system, with which it is so intimately related, the gastrointestinal tract and the kidneys function in utero." It has also been observed that ether, sodium amytal and morphine have a depressing effect on these intrauterine respiratory movements. If we accept these observation as proved facts, we must also agree with Eastman[12] that "it throws a greater burden on the obstetrician to preserve a very delicate mechanism which is already in existence but which is easily disrupted."

To enable this delicate mechanism to initiate normal respiration after the birth of the baby, it must have the following requisites:

1. A receptive, functioning respiratory center, integrated with
2. Respiratory muscles capable of response.
3. An ample supply of oxygen.
4. Clear upper respiratory passages.
5. Distensible lungs.

Absence of any of these essentials, or of several in combination, results in asphyxia.

Bonar concluded from his researches that "we should consider this whole subject as one of anoxemia rather than cyanosis or asphyxia." He estimated that about 85 per cent of all neonatal deaths are associated with anoxemia in some form. Since all asphyxiated newborn infants are known to be anoxemic, all well-reasoned attempts at resuscitation should be based on this accepted fact.

Before selecting the best method of resuscitation suited to the specific case, we must consider the two main types of asphyxiated infants, the livid, or blue, and the pallid, or white. We further subdivide them into those occurring at birth and those with recurring respiratory difficulties during the first few weeks and often little or no disturbance at birth. The first type, asphyxia livida, constitutes a much milder form in most instances, in which there is a satisfactory pulse, good muscle tone and active pharyngeal and other reflexes. Asphyxia pallida, the more serious condition, is akin to surgical shock, principally referable to birth injuries, especially intracranial. The latter are characterized by a rapid, thready pulse, generalized flaccidity and absent reflexes.

All unusual conditions occurring in pregnancy and labor must also be borne in mind because of their possible effect on the initiation of respiration. Special attention must be paid to the history of asphyxia in previous pregnancies, dystocia, etc., the length of gestation, duration of labor, instrumental or other interference, and the administration of sedatives and narcotics, particularly if the last are given within three hours of the delivery. The role of abnormal fetal position and disturbances of the fetal heartbeat must also be considered.

If the obstetrician anticipates asphyxia in the infant, he will be fully prepared to cope with the situation. Surely when it is fairly certain that the newborn will have difficulty with respiration, as in labor induced for a failing fetal heartbeat or in a cesarean operation when the baby will be anesthetized through the maternal circulation, it is essential that the means for handling any degree of asphyxia should be on hand.

We have found that aspiration of mucus, amniotic fluid, etc., from the nose, mouth and pharynx by means of a soft rubber syringe is all that is necessary to start breathing in the mildly livid babies in whom respiration is delayed only momentarily. Removing clotted blood and drying the body by gentle friction with a towel is claimed to have a beneficial effect on the basis of the older theory of afferent stimuli to the respiratory center.

The more severely asphyxiated babies must be handled gently at all times and controlled artificial heat supplied since the skin is frequently chilled by the failing circulation. The anoxemia found in all cases demands a continuous supply of oxygen to the lungs which cannot be accomplished until the upper air passages are cleared of fluid

and other obstructing material. The simple syringe method mentioned above will suffice in most cases.

Flagg and others feel that foreign material must also be removed from the trachea.[13-16] Some of these workers have found that the relaxed larynx with absent reflexes easily permits the blind introduction of a velvet-tipped catheter into the trachea and the aspiration of its contents by suction. Objecting to the inefficiency and dangers of blind catheterization, Flagg recommends, instead, the use of his specially designed laryngoscope for direct visualization of the field. This allows for intubation by direct vision, aspiration, and then insufflation of oxygen under pressures controlled by manometers. For 3 to 5 seconds, oxygen is supplied at a pressure of 25 mm. of mercury which is sufficient to stimulate the afferent leg of the Hering-Breuer reflex, consisting of impulses passing up the vagi at the end of inspiration, checking its depth and thus increasing the rate of respiration. He finds that by this method adequate oxygenation of the blood can be maintained for hours until the infant's respiratory mechanism takes over.

This method of resuscitation seems one of the best offered thus far, but there are some important, practical obstacles to its universal application. Introducing a laryngoscope is not a simple procedure, especially in a newborn infant and is certainly more difficult in the frequently asphyxiated premature babies. If a well-trained resident laryngologist were available at all times, we could expect a marked reduction in asphyxial deaths by the use of Flagg's method. In the great majority of hospitals such ideal conditions are not even approximated. In less skilled hands, the laryngoscope will not only be ineffective but may increase the danger in asphyxial states by traumatizing the larynx.

Direct mouth-to-mouth insufflation has been practiced for a long time. Obviously it is the simplest means of supplying oxygen and about 4 per cent carbon-dioxide, but, even if done through several layers of intervening gauze, it may introduce pathogenic organisms into the infant's mouth. There is also always the danger of using excessive pressures which can cause lung rupture, pneumothorax, and death.[17]

Inhalators for supplying resuscitating gases date from Woillez's spirophore described in 1876.[18] The modern machines afford a more reliable means of forcing oxygen or measured mixtures of oxygen and carbon-dioxide into the upper air passages through a mouth mask or pharyngeal or tracheal catheter. The amount and pressure of the gases can be controlled as desired. We used the Foregger inhalator for some years at Beth Israel Hospital with good results in the milder asphyxias of the newborn and even better results in the recurring respiratory difficulties of the first few weeks.

The use of resuscitating gases brings up the highly controversial issue of the superiority of one gas over the other in the stimulation of respiration. Yandell Henderson[19] was one of the first to reject the afferent stimuli theory of respiratory onset and to emphasize the important role of changes in the chemistry of the circulating and tissue fluids. His contention is that carbon dioxide is all-important in the chemical control of respiration. He claims that oxygen is necessary only to maintain the respiratory center in good physiologic condition and to enable the tissues to produce the essential carbon-dioxide. Oxygen can stimulate the respiratory center but only in a transient and ineffectual manner. His answer to the objection that the fetal blood already has a high carbon-dioxide tension is that the depressed respiratory center needs still greater concentrations of this gas to overcome the heightened threshold of irritability. He treats birth asphyxia by gentle insufflations with mixtures of 5 per cent, 6 per cent and at times even higher percentages of carbon dioxide with oxygen. For long-continued artificial respiration, Henderson advocates use of machines like the Drinker respirator in conjunction with carbon-dioxide-oxygen inhalations. Haggard, Coryllos[20] and many others[6, 13] agree with Henderson, and most of them use approximately the same percentage mixtures, but a few workers advise higher concentrations of carbon dioxide, or even the pure gas for several seconds, followed by pure oxygen and then finally the dilute mixtures, when respirations are almost normal in rate and depth.

Since the pioneer work of Henderson, other physiologists and chemists have taken issue with his findings, have shown that oxygen is superior to carbon dioxide as a respiratory stimulant and have gone so far as to state that carbon dioxide is not only superfluous but is also contraindicated in neonatal asphyxia. Eastman[21] contends that the existing acidosis may be aggravated by carbon-dioxide inhalations and that the chief therapeutic indication is for oxygen. In his paper, "Interplay of Piestic Factors at Birth,"[22] Krafka discusses Schmidt's theory of reversal of the respiratory center and explains it as an abnormal state of irritability of the center produced by a decreased blood supply and general anoxemia. In this condition with apnea, stimulation by carbon dioxide may cause further depression, whereas oxygen may shift the threshold of stimulation and initiate respiration by increasing the cerebral flow. Martinez[23] agrees with Kane that carbon-dioxide and oxygen mixtures have little or no advantage over straight oxygen. Experiments on dogs done by Cordier[24] show results contrary to those of Henderson and Haggard and confirm the findings of others that asphyxia is accompanied by acidosis.

We observed an asphyxiated newborn infant who remained intensely cyanotic with irregular respirations after several hours of carbon-dioxide-oxygen inhalations but the cyanosis cleared up promptly when pure oxygen was substituted.

Stimulation of the respiratory center by the administration of alpha lobeline injected intramuscularly or into the cord portion of the umbilical vein has been used by many with reported good results. We are indebted to Wilson and co-workers[25] for an excellent study of the umbilical cord route, checked by tracings of the infant respiration. This drug was used several times in our cases, but the results were not satisfactory enough to obviate the need for other methods of resuscitation. Some reports state that the injection of alpha lobeline was followed by convulsions and other toxic symptoms. In most cases, however, doses of $\frac{1}{20}$ grain are safe.

Since in many infants asphyxia is accompanied by internal hemorrhage, often unsuspected, we strongly urge the injection of whole blood intramuscularly in the routine treatment of all cases of marked respiratory difficulty and especially in the pallid type. In frank hemorrhage transfusions are definitely indicated. In addition to the acceleration of clotting, the very desirable supportive action has often been evident.*

The frequency of poor circulation and weakened heart muscle in asphyxia has led to the widespread use of cardiac, vasomotor, and medullary stimulating drugs by hypodermic or even intracardiac injection. It is difficult to evaluate such stimulation, but Poeck[26] considers it so important that he tries to anticipate asphyxia before the delivery. When signs of intrauterine asphyxia are found, he injects metrazol into the mother's veins or muscles or directly into the fetus if the presenting part, caput or buttocks, can be reached. Other drugs most frequently favored are coramine, epinephrine, and caffeine.[27-30]

Thus far we have discussed the simpler methods of resuscitation which should suffice for the treatment of all the milder forms of asphyxia neonatorum. There yet remain the deeply asphyxiated newborn infants who "are on the borderline of stillbirth."[19] To treat these cases successfully, we must rely on mechanical respirators or resuscitators. For prolonged, passive artificial respiration, the Drinker respirator has been found to be highly effective.[31-33] It may be described as an airtight metal cabinet in which the baby is placed with his head protruding, through a snugly fitted rubber collar, into the room air. Alternation of measured and controlled negative and atmospheric, or positive, pressures within the chamber is achieved by the attached electrically driven pump and a valve arrangement. During the negative pressure phase, air at atmospheric pressure enters the respirator through the infant's nose, mouth and trachea whence it is drawn into the lungs, and expands the chest. When the negative pressure is dissipated, the elastic recoil of the chest produces expiration. If desired, the expiratory movement can be made stronger by supplying positive pressure.

*Since this paper was written several reports on the beneficial effects of vitamin K in hemorrhagic disease in the newborn have appeared. (Waddell, W. W., and Guerry, D.: J. A. M. A. **112**: 2259, 1939.)

In 1933, I reported a series of thirty-five infants, twenty-three of whom survived, treated in the Drinker respiratory at the Newark

TABLE I

INFANTS DISCHARGED ALIVE (DRINKER RESPIRATOR)
SUMMARY OF BIRTH HISTORY AND TREATMENT OF 23 INFANTS WITH ASPHYXIA NEONATORUM

NO.	SEX	DELIVERY	CONDITION AT BIRTH	TREATMENT AND RESPONSE
1.	M.	Low forceps	Not breathing	Normal respiration rate in 10 minutes
2.	M.	Normal	Asphyxia livida	Responded
3.	M.	Normal	Asphyxia pallida	Alpha lobeline in cord. 3 gasps in first 10 min. Respirator, 30 min.
4.	F.	Normal, maternal hypertension	Asphyxia livida	Responded
5.	M.	Cesarean Mother eclamptic	Asphyxia pallida Occasional gasp	6 respirations a min. in first 10 min. Respirator, 30 min.
6.	F.	Cesarean Placenta previa	Asphyxia pallida Gasping	Normal respiration in 20 min. Treated 1 hour
7.	M.	Normal	Asphyxia livida Almost pulseless	30 min. in respirator
8.	F.	Induced Placenta previa	Asphyxia pallida	Normal respiration in 15 min.
9.	M.	Cesarean	Asphyxia livida Pulse fair. Narcotized	Much mucus in pharynx. First breath, 8 min. Regular in 15 min.
10.	F.	Breech extraction	Asphyxia livida Weak pulse	First breath, 4 min. Regular in 10 min.
11.	M.	Normal	Cord tight on neck Heart sounds faint	First breath, 6 min. Regular in 20 min.
12.	M.	Normal Prolonged labor	Premature, 8 months Asphyxia livida	Alpha lobeline in cord. First breath, 6 min.
13.	M.	Normal Gwathmey analgesia	Asphyxia livida Anesthetized	First breath, 5 min. Regular in 10 min.
14.	F.	Cesarean	Asphyxia livida	First breath, 6 min. Regular in 13 min.
15.	M.	Normal	Asphyxia livida	Responded promptly
16.	M.	Normal	Asphyxia livida Cried once	Alpha lobeline, adrenalin, CO_2-O First breath, 15 min. Treated, 2 hr.
17.	M.	Normal Gwathmey analgesia	Asphyxia livida Pulseless	First breath, 3 min. Treated, 30 min.
18.	F.	Low forceps	Asphyxia livida	Regular in 15 min.
19.	M.	Internal version Breech extraction	Asphyxia livida	Treated 25 min.
20.	M.	Normal	Asphyxia pallida Irregular heart	First breath, 5 min. Regular in 30 min.
21.	F.	Cesarean	Asphyxia livida. Anesthetized. Rapid, weak pulse	First breath, 3 min. Regular in 30 min.
22.	F.	Normal	Asphyxia pallida Premature, 8 months Heart irregular	First breath, 8 min. Regular in 40 min.
23.	M.	High forceps Rapid fetal heart	Asphyxia pallida Heart irregular	First breath, 8 min. Regular in 20 min.

Beth Israel Hospital[34] (Table I). We concluded that it was an effective treatment for deep asphyxia, and we found no pulmonary or other damage caused by its use in the ten infants who came to autopsy (Table II). For prolonged and interrupted treatment, this machine excels, since it gently carries on oxygenation of the lungs for as long as one hour and fifteen minutes with ultimate survival, as in a case reported by Murphy.[32] However, it takes a trained crew of at least three to

TABLE II

SUMMARY OF BIRTH HISTORY AND TREATMENT OF 12 INFANTS WITH ASPHYXIA NEONATORUM WHO DIED AFTER TREATMENT IN DRINKER RESPIRATOR, AND OF THE AUTOPSY FINDINGS IN 10 OF THESE CASES

NO.	SEX	DELIVERY	CONDITION AT BIRTH	TREATMENT AND AUTOPSY FINDINGS
1.	F.	Ablatio placentae Induced by bag	Asphyxia livida Premature, 7 months	Gasped twice in 30 min. No autopsy
2.	M.	Normal	Asphyxia livida. Pulseless. Bleeding from mouth	Responded with regular, shallow breathing. Died in 5 hr. Autopsy: Atelectasis. Hemothorax
3.	F.	Normal	Breathed normally for few minutes	Regular respiration for 10 min. CO_2-O while in respirator Autopsy: Intracranial hemorrhage
4.	F.	High forceps	Cord around neck	Treated 15 min. Autopsy: Intracranial hemorrhage
5.	M.	Normal	Asphyxia pallida. Cord vessels collapsed	Treated 15 min. No breathing Autopsy: Intracranial hemorrhage
6.	F.	Normal	Asphyxia livida Premature, 7 months	Normal, regular respiration, 30 min. Autopsy: Bilateral atelectasis
7.	M.	Normal	Asphyxia livida, gasping Premature, 7-8 months	In 20 min., 3 gasps a minute Autopsy: Diaphragmatic hernia Spleen and stomach in chest
8.	M.	Normal	Asphyxia livida Weak pulse	Normal breathing in 30 min. Cyanotic. Lived 18 days Autopsy: Transposition of aorta, etc.
9.	M.	Normal Gwathmey analgesia	Asphyxia pallida Premature, 7½ months	Breathed in 5 min. Expired in 48 hr. Autopsy: Bilateral atelectasis
10.	F.	Normal Gwathmey analgesia	Asphyxia pallida Cord tight around body	No response Autopsy: Adrenal hemorrhage
11.	F.	Normal	Cord around neck. Amniotic fluid, meconium in mouth	First breath, 20 min. Regular, 45 min. Lived 56 hr. Autopsy: Syphilis with extensive liver involvement.
12.	M.	Frank breech	Asphyxia pallida Weak, irregular heart	First breath, 10 min. Lived 1 hr. No autopsy

TABLE III

SUMMARY OF BIRTH HISTORY AND TREATMENT OF 23 INFANTS WITH ASPHYXIA NEONATORUM TREATED WITH THE E & J RESUSCITATOR, OF WHOM 18 WERE DISCHARGED ALIVE AND 5 DIED IN THE HOSPITAL

NO.	SEX	DELIVERY	MATERNAL MEDICATION AND ANESTHESIA	CONDITION AT BIRTH	TREATMENT AND RESPONSE	
					FIRST GASP	TOT. TREAT.
1.	F.	Low forceps	Morphine, G.O.E.*	Asphyxia livida	5 min. Good	8 min.
2.	F.	Normal	Quinine	Asphyxia pallida	2 min. Good	4 min.
3.	F.	Precipitate	Gwathmey	Asphyxia pallida Premature, 8 months	2 min. Good	3 min.
4.	M.	Frank beech	Ether whiffs	Asphyxia livida	2 min. Good	4 min.
5.	M.	Podalic version	Morphine, Gwathmey, G.O.E.*	Asphyxia livida Bloody spinal fluid	30 min. Good	1¼ hr.
6.	M.	Normal	Thymophysin	Asphyxia livida	2 min. Good	10 min.
7.	M.	High forceps	Gwathmey, G.O.E.*	Asphyxia livida	1 min. Good	2 min.
8.	M.	Cesarean	Atropine, G.O.E.*	Asphyxia livida	10 min. Good	15 min.
9.	M.	Normal	None	Asphyxia livida	10 min. Good	15 min.
10.	M.	Attempted mid-forceps. Int. version. Podalic extraction	Morphine twice, sod. amytal, ether	Asphyxia livida	10 min. Good	20 min.
11.	M.	Low forceps	Morphine	Asphyxia livida	1 min. Good	10 min.
12.	M.	Low forceps	Gwathmey, G.O.E.*	Asphyxia livida	4 min. Good	5 min.
13.	M.	Normal	Ether whiffs	Asphyxia livida	Immed. Good	45 min.
14.	M.	Cesarean	Morphine, atropine, ether	Asphyxia livida	5 min. Good	10 min.
15.	M.	Low forceps	Gwathmey	Asphyxia livida	1 min. Good	2 min.
16.	M.	Normal	Morphine, Gwathmey	Asphyxia pallida	1 min. Good†	3 min.
17.	F.	Normal	Thymophysin, Gwathmey	Asphyxia livida	4 min. Good	10 min.

*Gas-oxygen and ether.

†Received alpha lobeline injected into cord.

NOTE: When infant is recorded as breathing immediately after birth and then receiving treatment for some time, it means that the machine was used as an inhalator for most of this period.

TABLE III—CONT'D

NO.	SEX	DELIVERY	MATERNAL MEDICATION AND ANESTHESIA	CONDITION AT BIRTH	TREATMENT AND RESPONSE	
					FIRST GASP	TOT. TREAT.
18.	F.	Normal	Gwathmey	Asphyxia pallida	1 min. Good	2 min.
19.	F.	Normal	Thymophysin, ether whiffs	Asphyxia livida External bleeding	Immed. A. lobeline intram.	10 min. Died
20.	F.	Cesarean	Morphine, atropine, ether	Asphyxia livida Premature, 5-6 months	5 min.	10 min. Died, 36 hr. Convulsions
21.	M.	Footling breech Low forceps	G.O.E.*	Asphyxia livida External bleeding	7 min.	15 min. Died, 11 hr.
22.	F.	Normal	None	Asphyxia pallida Atelectasis	Immed.	2 hr. 20 min. Died, 4 hours.†
23.	M.	Normal	Nembutal	Asphyxia livida	?	10 min. Died. Autopsy: Intracranial hem. Tentorial tears

place the infant quickly and properly in the respirator, and I feel that often its use was delayed or avoided altogether for this reason. The literature contains only one instance of injury to the lungs, supposedly caused by the respirator. Ruptured emphysematous blebs and bilateral pneumothorax were disclosed at autopsy.[35] Our autopsy findings, summarized in Table II, reveal no such trauma and only pathologic conditions incompatible with life.

During the last two years, our experience (Table III) has been limited to the E & J resuscitator which has been accepted by the Council on Physical Therapy of the American Medical Association. This machine consists of a central cylinder and two attached tanks for oxygen or oxygen-carbon dioxide mixtures. The only source of power is the pressure of the tank-contained gas which is reduced in the cylinder to a positive pressure of 13 mm. of mercury and a negative of 9.75 mm. Continual alternation of these pressures is accomplished by a tripping mechanism in the cylinder which operates when the patient's intrapulmonary pressure reaches the predetermined limits of either positive or negative pressure. The volume of distensible lung tissue determines the rate of tripping. In our cases this rate was found to be approximately the same as the normal respiratory rate at birth. If at any time the upper air passages are obstructed, the mechanism trips very rapidly, giving ample, readily audible warning that aspiration is needed. The establishment of spontaneous respiration is signalled by irregular tripping. At this time, turning a lever mounted atop the central cylinder converts the machine into an inhalator, the desired gas being supplied to the infant through a re-

breathing bag. An expiratory valve can be regulated to control the amount of rebreathing as required. Various sizes of wire airways are supplied with the resuscitator and one of these should always be used during the procedure to help maintain patent upper air passageway.

The E & J resuscitator is equipped with a safety valve which prevents pressures higher than 18 mm. of mercury. According to the figures of Coryllos and other observers, this maximum is well within the safe limits. Martinez found no damage done to the lungs or other viscera in his autopsied cases. Careful search in our series of eight autopsies, analyzed in Table IV, also revealed an absence of such trauma.

TABLE IV

AUTOPSY REPORTS ON INFANTS TREATED WITH THE E & J RESUSCITATOR*

	NUMBER OF INFANTS
Intracranial hemorrhage	5
With tentorial tears	2
With fracture of skull	1
Atelectasis	2
Bilateral hemothorax and hemoperitoneum	1

*On account of insufficient clinical data, only one of these cases is included in Table III. (Case 23.)

Some objections have been raised against the resuscitator, the strongest coming from Henderson who has recently pointed out that it not only inflates the lungs but also deflates them, which is physiologically undesirable. He further states that "it opposes dilatation of the lung, causes, frequently, pulmonary injury as disclosed at autopsy . . . and after its application, survival of the baby is rare."[36] The survival of 377 of Martinez's infants, and our own results serve to disprove at least the last of these statements.

The Council on Physical Therapy warns that all resuscitators must be used only by properly trained personnel. It further explains that the E & J resuscitator has the opposite effect on the pulmonary circulation from that caused by normal respiration and that lung inflation even at moderate pressures retards circulation through the alveolar capillaries. It does not, however, consider the latter fact a serious objection since the retardation is only momentary at the peak of pressure.

After weighing all of the possible objections, we still must conclude that the E & J resuscitator has the advantages of being easily applied and of giving safe, satisfactory results in asphyxia of the newborn if the other essentials for adequate treatment are observed.[37] Since extensive atelectasis of the lung was found at necropsy in some of the cases, it is apparent that the apparatus is not effectual in all instances.

SUMMARY

1. A review of the literature shows a growing interest in infant resuscitation accompanied by a clearer understanding of the indications for its use.

2. The theory that newborn respiration is initiated by afferent stimuli to the respiratory center has been discarded. Therefore, there is no scientific basis for the use of cutaneous irritation or the various forms of shock therapy.

3. Studies in experimental animals and the human fetus disclose normal intrauterine, fetal respiratory movements in preparation for regular neonatal breathing. Anoxemia is the underlying cause of almost all disruptions of this mechanism.

4. The obstetrician plays the chief role in the prevention of asphyxia neonatorum. In many instances, he should be able to anticipate newborn respiratory difficulty and be prepared to cope with it. He must limit the use of maternal and fetal drugs which depress mother and child if the incidence of asphyxia is to be materially reduced.

5. The essentials in the treatment of asphyxia neonatorum are gentleness, warmth, clearing the upper air passages, and maintaining an adequate supply of oxygen. In the apneas occurring later, carbon dioxide is an efficacious stimulant.

6. A detailed discussion of Flagg's intratracheal insufflation, the Drinker respirator and the E & J resuscitator demonstrates their respective value in infant resuscitation. Advantages and limitations of each are pointed out.

7. Our experiences at the Newark Beth Israel Hospital with the Drinker and E & J machines are reviewed. We conclude that the Drinker respirator is a very effective means for long-continued artificial respiration. The E & J resuscitator is equally safe and effective and has the important advantage of being much more readily applied.

REFERENCES

1. Resuscitation: A Comment by the Secretary of the Council on Physical Therapy, J. A. M. A. **112**: 1946, 1939.
2. Forsyth, N. C.: Resuscitation at Birth by Eve's Rocking Method, Brit. Med. J. **1**: 619, 1934.
3. Riley, Franklin G.: Asphyxia Neonatorum, New Orleans M. & S. J. **86**: 301, 1933.
4. Gauss, C. J.: Principles and New Ideas of Treatment of Asphyxia Neonatorum, Deutsch. med. Wchnschr. **64**: 1313, 1938.
5. Jacobi, Abraham: Miscellaneous Addresses and Writings, Collectanea Jacobi, New York, The Critic and Guide Co. **1**: 380, **3**: 401, **6**: 17, 1909.
6. Shute, E., and Davis, M. E.: Resuscitation of Newly Born Babies Showing Narcosis, Canad. M. A. J. **29**: 252, 1933.
7. Maloney, A. H., and Tatum, A. L.: A Study of the Effect of Morphine on the Respiratory Center, J. Pharmacol. & Exper. Therap. **40**: 291, 1930.
8. Cole, W. C., and Kimball, D. C.: Relation of Maternal Sedation and Anesthesia to Neonatal Asphyxia, J. Pediat. **13**: 934, 1938.
9. Editorial: The Drinker Respirator in Asphyxia Neonatorum, Lancet **2**: 952, 1932.
10. Bonar, B. E., Blumenfeld, C. M., and Fenning, C.: Studies of Fetal Respiratory Movements: Part 1. Historical and Present Day Observations, Am. J. Dis. Child. **55**: 1, 1938.
Bonar, B. E.: Part 2. Recording Methods, ibid. **55**: 322, 1938.
11. Snyder, F. F., and Rosenfeld, M.: Intrauterine Respiratory Movements of the Human Fetus, J. A. M. A. **108**: 1946, 1937.

12. Eastman, N. J., and Bonar, B. E.: Panel Discussion on Cyanosis in the Newborn, J. PEDIAT. **9**: 262, 1936.
13. Flagg, P. J.: The Treatment of Postnatal Asphyxia, Am. J. Obst. & Gynec. **21**: 537, 1931.
Flagg, P. J.: Asphyxia Neonatorum: The Pivot Upon Which Turns the Movement to Prevent Asphyxial Death, Surg. Gynec. Obst. **67**: 153, 1938.
14. McGrath, J. F., and Kuder, K.: Resuscitation of the Newborn, J. A. M. A. **106**: 885, 1936.
15. Swanson, Roy E.: Asphyxia Neonatorum, Journal-Lancet **57**: 186, 1937.
16. Marchetti, A. A.: Resuscitation of the Newborn, Am. J. Surg. **35**: 259, 1937.
17. Emmert, Fred: The Danger of Mouth-to-Mouth Breathing in Resuscitation of the Newborn Infant, Am. J. Dis. Child. **39**: 1268, 1930.
18. Von Wachenfeld, S.: The Resuscitation of Newborn Asphyxiated Infants, Acta Obst. et Gynec. Scandinav. **9**: 601, 1930.
19. Henderson, Yandell: The Prevention and Treatment of Asphyxia in the Newborn, J. A. M. A. **90**: 583, 1928.
20. Coryllos, Pol N.: Atelectasis, Asphyxia and Resuscitation in the Newborn, Am. J. Obst. & Gynec. **21**: 512, 1931.
21. Eastman, N. J.: Fetal Blood Studies: III. The Chemical Nature of Asphyxia Neonatorum and Its Bearing on Certain Practical Problems, Bull. Johns Hopkins Hosp. **50**: 39, 1932.
Eastman, N. J., Dunn, R. B., and Kreiselman, J.: Am. J. Obst. & Gynec. **36**: 571, 1938.
22. Krafka, J.: Interplay of Piestic Factors at Birth, Am. J. Dis. Child. **45**: 1007, 1933.
23. Martinez, D. B.: The Mechanical Resuscitation of the Newborn, J. A. M. A. **109**: 489, 1937.
24. Cordier, D.: Studies of Acidosis by Asphyxia, Ann. de physiol. **11**: 138, 1935.
25. Wilson, R. A., Torrey, M. A., Johnson, K. S.: Respiration in Asphyxia Neonatorum, Surg. Gynec. Obst, **65**: 601, 1937.
26. Poeck, Ernst: Treatment of Infantile Asphyxia During Birth, München. med. Wchnschr. **84**: 331, 1937.
27. Von Wachenfeld, S.: Resuscitation of the Newborn, Monatschr. f. Geburtsh. u. Gynäk. **72**: 185, 1926.
28. Kermauner, F.: Treatment of the Asphyctic Newborn, Wien. klin. Wchnschr. **39**: 1070, 1926.
29. Garipuy and Mériel, P.: Intracardiac Injection of Epinephrine, Presse méd. **34**: 180, 1926.
30. Home, R.: Use of Coramine in Asphyxia Neonatorum, München. med. Wchnschr. **82**: 823, 1935.
31. Drinker, P., Shaughnessy, T. J., and Murphy, D. P.: The Drinker Respirator, J. A. M. A. **95**: 1249, 1930.
32. Murphy, D. P., and Coyne, J. A.: The Use of a Modified Drinker Respirator in Treatment of Asphyxia Neonatorum, J. A. M. A. **95**: 335, 1930.
Murphy, D. P., Drinker, C. K., and Drinker, P.: The Treatment of Respiratory Arrest in the Drinker Respirator, Arch. Int. Med. **47**: 424, 1931.
Murphy, D. P., Ross, B. W., and Bowman, J. E.: The Drinker Respirator Treatment of the Immediate Asphyxia of the Newborn, Am. J. Obst. and Gynec. **21**: 528, 1931.
Murphy, D. P., Bowman, J. E., and Wilson, R. B.: Late Respiratory Failure of Immature Infants Treated Successfully in Drinker Respirator, Am. J. Dis. Child. **42**: 1075, 1931.
Murphy, D. P. and Sessums, J. V.: Asphyxia Neonatorum, Surg. Gynec. Obst. **40**: 432, 1932.
Murphy, D. P., and Bauer, J. T.: Lungs After Treatment of Asphyxia Neonatorum in the Drinker Respirator, Am. J. Dis. Child. **45**: 1196, 1933.
33. Rascoff, H.: The Use of the Drinker Respirator in Asphyxia Neonatorum, Arch. Pediat. **52**: 414, 1935.
34. Heyman, A.: Asphyxia Neonatorum, J. M. Soc. New Jersey **31**: 98, 1934.
35. Deissler, K.: Traumatic Emphysema and Pneumothorax After Artificial Respiration by Mechanical Means, Trans. Northwestern Pediat. Soc., Am. J. Dis. Child. **45**: 908, 1933.
36. An Open Letter by Dr. Yandell Henderson, J. A. M. A. **112**: 1946, 1939.
37. Coryllos, P. N.: Mechanical Resuscitation in Advanced Forms of Asphyxia, Surg. Gynec. Obst. **66**: 698, 1938.

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Proceedings

NINTH ANNUAL MEETING OF THE AMERICAN ACADEMY OF PEDIATRICS

CINCINNATI, Nov. 16-18, 1939

Round Table Discussion of Infant Feeding, Including Constipation and Colic

Chairman: Franklin P. Gengenbach, M.D., Denver
Assistants: Edgar P. Copeland, M.D., Washington, D. C.
Julius H. Hess, M.D., Chicago

CHAIRMAN GENGENBACH.—When I graduated from medical school forty years ago, I believed that all infants should be nursed or bottle fed every two hours during the day and every three hours at night. This was but a slight advance over the practice of many mothers in feeding their babies every time they cried.

Subsequent observations in the course of medical practice led to the belief that a baby will usually awaken for his feeding when he is hungry and that many babies would go three hours, four hours, and even longer, particularly at night, between feedings.

When mothers could not nurse their babies, the latter were almost invariably placed upon some proprietary infant food, occasionally on a modified cow's milk formula. Those infants fed on proprietary foods frequently developed rickets, and some of them, scurvy. Where a modified cow's milk formula was used, emphasis was placed on the giving of raw milk. The constant endeavor was to so modify the cow's milk as to approach as closely as possible, the chemical composition of human breast milk. As a result of this endeavor, there was introduced the percentage method of infant feeding. Attempts to improve upon this percentage method led to the top milk method of Chapin in New York and the split protein method of Rotch, Morse, and Maynard Ladd in Boston.

A detailed discussion of all the suggested methods used in the past in the feeding of infants and the names of the men who proposed them would require all the time assigned to this round table so only a few high lights will be mentioned to bring the subject up to the present time, when Dr. Julius H. Hess discusses the present status of breast feeding and Dr. Edgar P. Copeland discusses the present status of artificial feeding with the frequently associated colic and constipation.

Because the bottle-fed infant, when he had indigestion, usually had curds in the vomitus and curds in the stools, it was believed that the infant had difficulty in digesting cow's milk because of its high percentage of protein and also the character of the split proteins as compared with breast milk. To a pediatrician of average mathematical intelligence, the top milk method advocated by Chapin was easily comprehended, but to follow the split protein method of the Boston school, one needed, forsooth, to carry in one's pocket the card of formulas so cleverly devised by Ladd.

To further the infant's digestion of cow's milk, Abraham Jacobi advocated the use of cereal diluents; the German school advocated boiling of the milk; and others the use of sodium citrate added to the formula instead of lime water.

Later, curiously enough, the use of alkaline substances was replaced by the addition of acids, particularly organic acids, to the cow's milk. For this apparently revolutionary change, we are largely indebted to the biochemical studies of the late Dr. Marriott and his associates. Later, Brennemann, as a result of his interesting study of the action of various milk formulas in the stomach, pointed out that comparably good results might be attained without acidifying the milk.

No matter what type of bottle feeding the pediatrician uses, whether it is prepared in the home or bought at the drug store, one cannot help but be influenced by the results obtained.

Suffice it to say in concluding this introductory portion of the round table discussion, that your chairman is thoroughly convinced that to be successful in infant feeding, the pediatrician must be conversant not only with the merits of the various milk formulas and commercially prepared milk and other food preparations, but also the study of the digestive capacity of the infant in hand together with its individual idiosyncrasies, allergic or otherwise, for there can be no "rule of thumb" in infant feeding.

Breast Feeding

Julius H. Hess, M.D., Chicago

After attending what for me seemed to be a most enlightening clinic more recently conducted by one of our foremost Chicago pediatricians, and hearing the following remark from one of the audience: "He has told us nothing we did not know," I appear most humbly before you in the hope that some of my statements may be carried over to such of our colleagues at whom they may be directed, rather than with any thought that they may be enlightening to you, as pediatricians.

Few who have had experience in the management of infants will deny the importance of breast feeding, but many who acknowledge its importance do little to encourage it. I am certain we are all agreed that many more children should be breast fed than are at the present time. There are many possible causes of failure on the part of the mother to meet her infant's needs, but faulty management is undoubtedly the most common. Some error in commission or omission in the advice given to the mother is in the majority of cases responsible, and as soon as difficulties arise, mothers are all too likely to be advised to wean their infants and substitute artificial feeding.

It remained for Oliver Wendell Holmes to furnish us with an aphorism which summarizes our best thought on breast feeding. I quote: "A pair of substantial mammary glands have the advantage over the two hemispheres of the most learned professor's brain in the art of compounding a nutritive fluid for infants." To Abraham Jacobi was left the follow-up on Holmes with his maxim: "And in the absence of an adequately secreting pair of breasts, the most important ingredient in the infant's formula is the physician's brains." To Dr. Copeland we grant leave to expound Jacobi's dictum.

Joint Responsibilities of the Obstetrician and Pediatrician.—The first days are the danger period to successful breast feeding. First, the obstetrician provides for the mother his most solicitous attention; he has practiced his best obstetrics and has presented her with a normal, uninjured infant. His fears, if any, are centered on the possibility of post-partum complications in the mother. Not the least of these is his desire to avoid trauma to the nipples, with their further danger of secondary breast infection.

Prenatal Care of the Mother's Breasts.—The question is why do so few obstetricians give thought to the preparation of the mother's breasts for their natural function, which must provide a nipple which the infant can grasp, and one which will stand for the early trauma of the nursling's sucking without developing vesicles and fissures.

Early and regular massage of the nipple and breasts, during the later months of her pregnancy, will I am firmly convinced eliminate at least 10 to 20 per cent of failures in breast feeding.

It has been my repeated experience on making the rounds of the newborn infants to have reported to me that the obstetrician has suggested, even ordered, that the infant should be taken from one or both breasts for fear of mastitis. These orders are usually preceded by a well-meaning talk to the mother in which the belief is expressed that she will not be able to nurse her baby, thereby setting up a vicious circle of lack of confidence, largely based on fear, which often offers an insurmountable obstacle for the pediatrician, who in the early days of the puerperium has played a very minor role as to his importance in the minds of mother, father, and well-meaning relatives. Even in such institutions in which the infant becomes the patient of the pediatrician from the time of birth, there is often evidence of the very adverse psychology practiced by the obstetrician. This may not make good reading for some of our colleagues, but I feel quite certain that few of you have failed to feel the interference with what should be your just responsibility to the mother and her infant. Only too often through lack of conferences and a definite understanding as to the importance of minor breast pathology, the mother does not have the definite feeling of confidence and security in the judgment of the pediatrician so necessary to a successful breast-feeding program.

The Mother's Post-Partum Vacation.—I speak of the puerperium as providing the mother with a hospital vacation. Here she feels a great sense of security, whether it be in her private room or in the well-organized ward. At stated intervals, her infant is brought to her, wrapped in warm blankets after being snuggled against the breast of the nurse en route from the nursery. Even though the infant has been lustily crying for his meal in the nursery, upon being showered with all this special attention, he quickly quiets down, and by the time he reaches his mother's bedside, he is quite content for the moment. He is now placed at the breast and, we hope, is provided with a nipple sufficiently developed so that he can take it and even in his early days receives a reward for his effort. Even though he may not be satisfied with the results of his labors, before he has an opportunity to demonstrate his discontent, he is again whisked away to the nursery to receive a "filler."

We know, but the mother does not, of the bedlam in the nursery, often long before feeding periods. He who states that young infants cannot hear should learn his physiology of the auditory apparatus from contact with the nursery, where the first cry from one infant is followed by a rapid succession of outbursts on the part of the remaining inmates of the nursery. We can well appreciate that a good cry is the best of physical exercises that we are able to provide for the newborn, but the mother has not been so informed.

Only too frequently and too early in the very first days, the infant comes in contact with the easy flowing content from the bottle. If it is to his taste and is filling, he becomes lazy and refuses to help his mother develop her breasts to meet his needs. Therein lies the cause of a high percentage of babies' being discharged from our hospitals on unnecessary bottle feedings. In only too many instances the giving of these feedings is a matter of nursery routine, often without consultation with the obstetrician or the pediatrician. Formulas 1, 2, and 3 are given to the infant at the discretion of the nursing staff alone. This can

only be corrected by the physician's personally assuming the responsibility of directing the feeding of the newborn infants and determining the policy of the hospital regarding nursery procedures. As previously stated, this can only be accomplished by complete confidence and mutual understanding between obstetrician and pediatrician.

Every mother should be taught manual expression while still in the hospital. The nursing division has not performed its obligation to the mother and infant unless the mother has been taught manual expression, if for no other purpose than that breast bottle feeding can be provided in case of emergency. The electric pump has a large and successful place in the hospital nursery; however, it carries the danger that hand expression may not be taught the individual mother. The infant is, of course, by all odds the best breast pump.

Preparation for Discharge.—By the tenth or twelfth day the average mother is discharged from the hospital and assumes the responsibility for the care of her infant in the home. With what preparation does the average mother in moderate circumstances who cannot afford a trained nurse or nurse maid assume her home care of the infant?

The individual instruction in some well-organized hospitals is good; in most of them it is indifferent. She is given some printed directions, a Board of Health or Children's Bureau Pamphlet, God's blessing, and the good wishes of the obstetric department, provided she has paid her bill. When, in at the most four hours from the time she has left the institution, the infant starts the well-rehearsed performance which he has so well practiced, and which has achieved the desired results, but with which the mother was so little acquainted, then there starts the chain of circumstances which I am sure I do not have to recount for your information, for they are only too well known to you, your own household, and the telephone company.

Initial Weight Loss.—Much stress has been placed on the thought that a weight loss greater than a theoretically safe percentage of body weight is a dangerous adventure. This unjustifiable fear is responsible for the artificial feeding of many infants. I do not at this point wish to minimize the dangers of too great dehydration and the presence of hypoglycemia in the newborn, and more especially in the premature and immature infants and infants born of diabetic mothers. In the latter infants, in the presence of intrauterine hyperglycemia of both the mother's and infant's blood, the islands of Langerhans of the fetal pancreas are overstimulated, and this, when carried over into the first days after birth, may result in a severe hypoglycemia in the infant which calls for early recognition and treatment.

Sanford[1] reports the following conclusions from his study on 4,622 newborn infants who were given various forms of complementary feedings or breast milk alone. Regardless of whether complement is used, approximately 33 per cent, or one-third of the newborn infants, will lose between 5 and 8 per cent of their birth weight. The higher the caloric value of the complement, the less the loss of weight. When 5 per cent dextrose was used as a complement for one-half of the newborn infants, the loss was only 5 per cent or less of the birth weight. Among infants not given any complementary feedings but placed at the breast six times in the course of twenty-four hours, he found that approximately one-sixth of them lost 10 per cent or more of their birth weight. With 5 nursings in the twenty-four-hour period, one-fourth lost 10 per cent or more. About half of the newborn infants, given complementary feedings, regained their birth weight within ten days from birth. In the newborn infants given no complementary feedings but nursed six times, one-fourth returned to birth weight at the age of ten days, and with 5 breast feedings, one-seventh. These differences in the two groups can be accounted for by the greater initial loss. Actually, the gain of weight is proportionately more rapid in those receiving no complementary feeding. Schick,

[1]Amer. J. Dis. Child. 15: 912, 1939.

in a discussion of Sanford's paper, recommends that infants below 2,000 grams should be kept under close observation and eventually should get complementary feeding, whereas the stronger infants should, as a rule, be left to forage for themselves. Justifiably, he states that extreme starvation in the newborn period should be avoided and that all infants should be observed for clinical signs of underfeeding, as evidenced by acetone odor on the breath and in the urine, both of which he has observed within forty hours after birth.

I wish to emphasize the fact that if the pediatrician does not have access to the mother's breasts so that he may judge their ability to respond to the baby's efforts or those of manual expression, his responsibility to the newborn is not fulfilled.

At the Michael Reese Hospital the following is the routine practice: Normal full-term infants are placed at the breast six hours after delivery, and thereafter at four-hour intervals five times during the twenty-four hours. Water without carbohydrate addition is fed to the infant six times in twenty-four hours, in amounts of one ounce at first and up to two or three ounces later. Infants are kept under close observation for evidence of inanition. If at the end of seventy-two hours, the breasts are still not secreting an adequate amount of milk, a formula is started after the infant has been at the breast. Both breasts are offered if indicated. In our experience, the average infant leaving the hospital at the tenth day after birth has reached a weight within 100 to 150 grams or less of its birth weight.

Caloric Requirements in Breast Milk Feeding of the Premature Infant.—I believe that there is a tendency on the part of many of us to overfeed the young premature infant. This is often based on our desire to have the infant gain as much and as quickly as possible with the result that the infant develops at least the minor complications of vomiting, colic, distention, often accompanied by cyanosis and diarrhea.

It is essential that we first ascertain the infant's tolerance for its food, inasmuch as the intestinal tract, as well as the other organs, is underdeveloped. Starting with very small quantities and increasing the amount slowly is always a safe rule. It is our experience that the infant does best if we feed him the smallest amount of food with which he will gain weight, rather than attempt to produce a rapid and early gain. The premature infant, in our experience, is rarely fed over 100 calories per kilogram per day of breast milk during his first month of life. Many will make good progress on from 60 to 80 calories per kilogram. After the first month we do not hesitate, if the diet is well taken, to give the infant 110 to 120 calories per kilogram per day if his weight curve is not satisfactory. With these early minimum feedings, abdominal distention with resulting dyspnea and possible cyanosis, vomiting, and diarrhea are minimized.

Colic in the Breast-Fed Infant.—To appreciate "colic" fully one must be the father of a breast-fed infant. Allow me to relate what to my mind constitutes a colicky breast-fed baby. It is the infant who suffers from intermittent, paroxysmal, and severe attacks of sharp, intense pain referable to the intestinal tract. The baby screams from pain with each recurrence of increasing intestinal peristalsis, he becomes flushed, his arms are stiffened, and his legs are usually brought up and pressed against his abdomen. He screams as if the pain were intensely agonizing.

There may be a striking periodicity with a marked tendency to recur more often in the late afternoon or evening, and the attacks may last far into the night. The discomfort may be aggravated by food, or, more commonly, the breast is refused until the attack has passed. It often ends suddenly with the spontaneous expulsion of flatus, or an enema may bring relief, if there is not expulsion of flatus. Occasionally, a single enema is not sufficient. Less intense attacks are

commonly relieved by gentle pressure of the abdomen against the mother's breast, placing the infant face down, the abdomen across her knees or a hot water bottle.

Recovery may be a matter of days, or it may be weeks or months before this is accomplished. The so-called neuropathic infant may be considered as offering a fertile field for the manifestation of colic.

Brennemann offers us an interesting speculation as to its pathogenesis, in that he believes that a rational explanation of colic is found in the fact that the baby comes into the world more "underdone" than the young of other animals; that its intestinal tract is not yet equal in its earliest months to unusual, or even normal, demands, either in the matter of digestion or propulsion of its gaseous contents; that an excessive amount of gas accumulates in the intestines, especially fostered by the highly fermentable contents of breast milk; that as a result the overdistended intestines become kinked and acutely obstructed at the bends, and the effort to overcome this obstruction leads to colic on exactly the same basis as that of abdominal colic evidenced as "gas pains" after abdominal operations, in peritonitis, and during gallstone and renal attack crises.

In my experience it is more universally and intensely seen in breast-fed than in artificially fed infants. It is commonly more intense in infants making consistent progress, and therefore underfeeding is not the more common underlying factor. We must admit that underfeeding results in restlessness and expression of dissatisfaction manifested by crying, and often air swallowing with its resulting gastric distention, which is relieved by "burping," as well as evident satisfaction after feeding. Whether overlooked or neglected while the infant is still in the hospital, it becomes increasingly manifest after the mother returns to her home. Seemingly, at least, it therefore requires a more or less definite period of time to develop to its greatest intensity. Anxiety on the mother's part, with a decrease in her breast milk, may confuse the picture.

It has little relation to the nursing mother's menstrual periods, as the infant most frequently has passed through the so-named "three months" colic period before this function again becomes manifest. This, however, does not dissociate it from the possibility of a relationship with the period of involution in the mother.

The possibility of the fetus having become sensitized in utero or after birth to certain ingredients in the mother's diet might be considered as an explanation of its presence in some infants, but it is my belief that colic is far too common a condition for universal acceptance of this as a predominating factor.

Constipation.—Sooner or later every mother will ask her medical advisor to interpret for her the proper attitude to take in the presence of, let us speak of them as, poorly timed bowel evacuations. She has been advised on the early training of the infant for regulation of its going to toilet and has been faithful to her instructions. Now, some of her friends tell her that, according to their physician, the infant while at the breast will be as well off with a movement every second or even third day.

We must recognize that even in the nursling there may be many underlying causes and our first duty is to make a diagnosis. Constipation, so-called, we know may be due to the poorly balanced diet of the mother, underfeeding based on insufficient milk supply, poor nursing on the part of the infant, or one of a number of pathologic conditions in the infant, the least of which may be a tight anal sphincter. Taking it for granted that the quality and quantity of the milk supply are adequate and that there is no gross pathology, should the infant be assisted so that the bowel is stimulated to evacuate daily? My answer is yes. In the presence of the high carbohydrate in breast milk and a normal intestinal musculature, the residue should accumulate in the lower rectum. I

believe that a daily evacuation should be encouraged first, by early training assisted by suppository if needed, at the same time each day, later, through the psychic effect of posture alone. If a tight sphincter offers mechanical obstruction, it should be dilated. If these do not develop results, then assistance may be given the sluggish intestine by the temporary use of an intestinal stimulant of your choice.

Artificial Feeding—Constipation and Colic

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To what Dr. Hess has had to say in his introductory remarks about the failure to establish breast feeding, I wholly subscribe. With what he has told us about the failure of the average obstetrician to anticipate and prepare properly for the nutrition of the baby whose birth he so meticulously supervises, I entirely agree, but I have a growing conviction that some other factor, not yet understood and appreciated, is at work in the seeming reduction of this very important natural function.

As I see it, some women seem to have what I will call secreting breasts, others do not. With the first group, even in the face of acknowledged handicaps, milk is produced, and a breast-fed baby ensues. With the second only failure results, even with the utmost effort.

It has been my experience that in cases in which milk secretion is produced with great effort, the milk is most likely to be deficient in quantity or quality and the resulting feeding most unsatisfactory. Nor have I witnessed much success with the use of measures directed to its improvement. The function of milk secretion, I feel quite sure, is intimately associated with the subject of endocrinology, and will be better understood and perhaps controlled as our knowledge in that important field of physiology increases.

Until that time arrives, however, we must contrive to provide a substitute for what has been frequently referred to as the infant's birthright—human milk.

To look back upon the evolution of infant feeding during the past forty years, as perhaps some of us here present can, is to review an interesting experience.

I began to attempt the feeding of infants in the heyday of the so-called percentage method, and, while I realize that it had its inception in the idea of simulating human milk, I always thought of it as an intelligent way of keeping informed as to the composition of a given formula. In the same manner the caloric method appealed to me as a further check upon an apparently satisfactory situation rather than a complete scheme for arranging feeding. In the light of present knowledge both have lost importance, but do have an enduring usefulness that serves as an example of what past efforts in this field have contributed.

More recently in this period to which I have referred, biochemical research has put us in possession of certain basic facts in respect to the subject of nutrition which permit us to approach the subject of infant feeding with a little more scientific precision.

In planning the feeding for the infant today it is no longer sufficient to think in terms of protein, fat, carbohydrate, mineral salts, and water. Certain elemental factors, both organic and inorganic, notably the amino-acid constituents of protein, have been demonstrated to be specific and essential to normal nutrition, and must be present in any permanent planning. It is obvious that this has an important bearing on our consideration of feeding and fortunate that these essentials are found present in the various milks that we have used for substitution.

There has been a rapidly accumulating fund of information concerning the vitamins, and, while their commercial exploitation may perhaps have somewhat exaggerated their usefulness, the more exact knowledge of their nature and the essential role they play has already proved of inestimable value.

Three conditions are to be satisfactorily met if artificial feeding is to be successful:

1. The food must be acceptable to the particular infant.
2. It must be one that he can utilize.
3. The food, having been utilized, must provide for optimum growth and development.

With the dearth of knowledge, respecting more particularly the quantitative consideration of the essential factors in nutrition, there has been for some time a tendency to supplement the milk feeding of the infant at an earlier and earlier age with various foodstuffs—cereal, egg, vegetable, etc. Whether this practice is wholly correct or not, is for continued experience to determine.

Cow's milk has formed the basis of most of the artificial feeding and while the physiologist and more recently the biochemist have contributed so helpfully to its adaptation to the needs of the human infant, it has been at best a clumsy substitute. Success has been largely a matter of the infant's ability to adapt himself to adverse conditions. It does, however, as has been said before, contain the essentials of a normal nutrition and is, therefore, the only substitute known at this time commercially available.

Many basic modifications of cow's milk, biologically designed originally to meet the requirements of a rapidly growing calf, have been made in an endeavor to bring its essential factors within the digestive and assimilative capacity of the more slowly developing human infant. Of all of these, the process producing evaporated milk, not originally worked out for the purpose, seems to best meet most requirements in the majority of cases, and the product possesses the added advantage of being universally (at least in America) available and relatively cheap.

In the process of digestion its casein presents an extremely fine curd of low tension, comparing in this respect quite favorably with that of human milk, and the fat globules in its emulsion are so finely divided as the result of homogenization as rarely to give trouble from that source. It lends itself readily to all modifications to which so-called "fresh milk" may be subjected, with the possible exception of fat reduction, and that is not often found necessary in its use and in the unusual *concentrations* in which it may be employed is of great value in the feeding of the newborn and premature infant.

Since we began the more or less routine use of evaporated milk some years ago, it has been our practice to add only egg yolk and possibly iron, as an inorganic salt or as in fruit, to the diet up to a point where 13 ounces of milk ceases to meet the infant's theoretical need. This may come at five months or sooner, but only then in the absence of special indications do we begin cereal, reserving vegetables for a later period.

Some allergists at least have drawn attention to the greater permeability of the infant's gastric and intestinal mucosa, suggesting the possibility of the absorption of insufficiently broken down proteins and consequent sensitizations that may contribute to problems in later life. This is indeed an important field, in which we have all had some experience, from the mildest manifestations of sensitivity to the violent reactions to even milk itself, often precluding its use.

All in all, however, we no longer approach our feeding problems with the timidity of former days. We feel better prepared to evaluate nutrition in the

infant, to recognize the results of so-called deficiencies and, recognizing them, to provide for their correction. Artificial feeding is adaptable to most normal infants when necessary, but this is not universally true as many can sorrowfully testify, and the difficulties will always be very directly related to the age at which the attempt is made.

We are now asked to give our attention to two subjects which may be very directly associated with feeding, namely constipation and colic. Most of us will agree that by constipation we mean the functional failure of the bowel to adequately evacuate itself. The qualification "functional" will serve to eliminate failure dependent upon malformation or disease. This type of constipation is almost peculiar to the artificially fed infant, and is better appreciated if we are reminded of the anatomical peculiarities of the infant's gastrointestinal tract and the physiologic problems offered by foreign foods early in life. A redundant sigmoid loaded with the excess waste products of artificial food certainly contributes to bowel stasis at the outset.

We shall divide the consideration of this disorder into two parts: first, the problem presented by the infant under our care from birth, and hence mostly prophylactic, and, second, the infant coming under our care at some subsequent period with the disorder already established.

The important consideration in the first group is the establishment and maintenance of normal bowel habits. Even in hospitals young mothers are too often poorly advised as to the normal physiology of the infant's eliminations. Seldom is it explained that their red-faced, grunting little darlings are in the throes of a perfectly normal physiologic procedure. Rather are they told that his stool must come each day if dire consequences are to be avoided. The milk of magnesia or the suppository is produced, and constipation is off to a fair start.

Let me quote Aldrich, *Gratification in Early Development*, "Thus the evacuation of the bowels begins as a simple organ reflex under the compulsion of the mass movement. As the infant learns by experience that the discomfort of rectal distention is relieved by muscular effort of elimination, the act becomes pleasant, positively conditioned and later on under favorable circumstances comes under voluntary control as one of life's agreeable sensations."

Being convinced, therefore, that the daily evacuation is so largely a matter of habit, we stress the proper education of the mother and nurse and carefully avoid artificial stimuli both medical and mechanical. We urge the mothering or handling of infants at the bath and at other times, preferably when they are not crying, with passive exercises and gentle abdominal massage. In actual necessity where initiative is lacking or impaction threatens, formula adjustments usually suffice for correction. Though all sugars are laxative, I have never been able to observe that one was better than another in this respect. Malt preparations we have not used for a long period. Prune juice—home made—and later strained prunes have been most helpful and, prior to the addition of other iron-containing foods, supply this valuable element in appreciable amount.

Once the proper habit is established, little trouble is to be expected, but beware of the "brisk purgation" with which so many, lay and professional alike, initiate the treatment of colds and other minor ailments. Weeks are often required to restore normal conditions after such therapy.

The infant in the second group, badly trained, accustomed to dependence upon daily assistance from medicine, enemata, etc., with the constipation habit thoroughly established, presents a more difficult problem. Its solution will call for, first of all, an unlimited confidence in the physician and an infinite patience. No single royal road to success exists. The enema should be resorted to for the immediate relief, while medicinal assistance (of which emulsified mineral oil is one of the best), and a laxative diet, abundantly supplemented with some acceptable form

of fruit, especially prunes, is a suggested program. Each infant must be symptomatically treated as an individual case. We have not used laxative malt preparations to any extent for a long time.

The true significance of the vitamins in constipation remains to be determined. It must always be remembered that certain abnormal conditions within the gastrointestinal tract may very possibly interfere with the absorption and use of vitamins even when present in the food in apparent abundance.. B_1 and the B complex have seemed to us to be helpful in certain instances of constipation and anorexia.

Now a word about the endocrines or more especially the thyroid. Bowel sluggishness may be one of the expressions of a slight degree of hypothyroidism. Its seeming response to the therapeutic experiment of small doses of thyroid would seem to be the only practical criterion for diagnosis in the age group with which we are dealing.

Seemingly, we cannot escape the allergist, and he will want us to give thought to the spastic gastrointestinal tract of the allergic infant. It has always been the impression that spastic colitis at least was a rare incident in the infant.

Now to the consideration of infant colic. Dr. Brennemann in his inimitable way has drawn a picture of the "colicky" infant that is all but a classic. He tells us that the disorder is more common in the breast-fed infant. I most regretfully have to say that I do not see enough breast-fed infants to verify this observation. While I do not see the breast-fed infants, I see many with what we are pleased to call colic. Why is it that so many infants, adjudged normal by any acceptable standard, have their little crying spell each day, and why does that spell most often occur in the evening? I give up and am forced to join the passing generations of laymen in that age-old expression "three months colic."

Colic is a very real complaint. It is confined to the first three or four months of life and has so far remained a controversial subject. I am sure the idea did not originate with him, but Cicero was among the first to record "that man believes true those things which he wishes to be true." I have no new answer for the infant's colic. Of course, we know that the hungry baby cries, and further, an important observation, that feeding oftentimes quiets the crying infant who could not be hungry by any possible construction. He need not be constipated, he need not be "gassy," and nutritionally he may leave nothing to be desired as to progress or present condition, but he is a hypertonic little creature, with a low threshold of excitability, usually living in a supercharged atmosphere under the care of persons with a setup similar to his own.

I find it possible oftentimes to appraise the character of a home environment from merely observing the behavior of the infant.

Gastrointestinal peristalsis is a rather complicated mechanism, and it requires no stretch of my imagination to picture the difficulties that could follow a failure of the sympathetic and parasympathetic properly to coordinate their conflicting functions. Faulty coordination is a conspicuous shortcoming in the period of the infant's life in which colic is observed and to my mind is the most tenable of explanations for this very vexing complaint. So far as I have been able to determine, the colicky infant is not the victim of digestive disorder, and the constant shifting of formulas in an attempt to meet the condition is to be decried. He should, it must be remembered, have an opportunity to make some adaptations of his own to the properly thought-out diet. A successful adjustment of environment or an improvement in hygiene is often more effective than ill-advised manipulations of the formula. Obviously errors in feeding, if they exist, should be corrected, and if indicated attempts should be made to meet the digestive capacity of the infant if it is lowered from any cause.

No discussion of infant colic would be complete without reference to the possible role of allergy. Allergists are more or less agreed that sensitivity in the infant, usually to cow's milk, is the exciting cause of colic in many instances, but they are not agreed, I believe, as to whether such sensitivity is inherent or acquired. Most of us are familiar with the rare infant that cannot take cow's milk and with the larger number that adjust themselves to it with the greatest difficulty.

Much of present-day infant feeding is based upon a refined empiricism, and so it is that we have come to make changes on occasion without reason other than that such changes have proved advantageous in previous similar circumstances. Such an instance with us has been the employment of banana powder as a substitute for sugars customarily used. Our apparent success with this carbohydrate in colic and nutritional disturbances has been very gratifying.

And as a final word—a note of warning—be sure of the diagnosis; young infants do have appendicitis and they do have intussusception.

Obviously these few words do not constitute a summation of artificial feeding, constipation, and colic, but it is hoped that they may serve as an outline for the discussion anticipated at a round table session.

DISCUSSION

Colic.—A lively discussion on colic arose. Questions such as "why does colic so often occur only in the late afternoon and early evening" by Dr. Munns (Winnetka) was followed by Dr. Bruce's (Louisville) interesting question, "Don't you think that a three-month colic might be due to introversion on the part of the infant and that he changes at about three months of age from an introvert to an extrovert?" Dr. Hess, who confessed he was not a good Freudian, said he was unable to answer. Questions by Dr. Bond (Wheeling) and Dr. Bush (Rochester, N. Y.) prompted Dr. Copeland to quote from his paper on the use of banana powder as a substitute for other sugars on an empirical basis, which in his experience relieves colic to a considerable degree. Dr. Hess reiterated the need of making a true diagnosis and not blindly accepting a case as colic, and treating a bellyache, and agreed with Dr. Gengenbach in recommending the use of suppositories in aiding the relief of symptoms. He also concurred with Dr. Epstein (Cleveland) that the addition of protein milk is of help especially in the breast fed, which also answered Dr. Manace of Toronto. Anal sphincter dilatation manually or by suppositories was suggested by Dr. Keiter (Kingston, N. C.). In response to medical therapy questions by Dr. VanOrder (Chattanooga) and Dr. Matthews (Montclair, N. Y.) the subject was put to a vote. The great majority of those present were using barbiturates with or without atropine. Dr. Copeland opposed the prolonged use of these. Dr. Munns (Winnetka) was afraid of degenerative changes through the prolonged use of barbiturates. Dr. Hess suggested the use of calcium chloride and gluconate, and Dr. Gengenbach, the old-fashioned carminatives with syrup, preferring paregoric to luminal. The question of allergy as a factor in colic was brought up by Dr. Glaboff (Louisville).

Constipation.—After some preliminary bouts between Dr. Hess and Dr. Munns, the question of the necessity of the daily bowel movement was put to a vote.

In regard to breast-fed babies, the answer was overwhelmingly "No," and for those artificially fed, "No," if the baby is comfortable. The intelligent and careful use of suppositories and enemas was said not to be conductive to later constipation in answer to Dr. William (Hamilton, Ont.). Dr. Margolis (Coatesville, Pa.) prompted Dr. Hess to state that boiling the milk increased the digestibility of the milk leaving less residue, and suggested that constipation be treated by the addition of egg yolk and orange juice to the diet. Dr. York (Schenectady) asked

about marble-like stools on which Dr. Copeland suggested the addition of starch or sugar or the addition of homemade prune juice as opposed to commercial prune juice suggested by Dr. McEnery (Chicago) for fear of the possible presence of some deleterious preservative. In regard to oil and oil emulsions, Dr. Copeland and Dr. Gengenbach thought the fear of lipoid pneumonia and failure of assimilation of oil-soluble vitamins was overdone. However, a show of hands revealed five of thirty-five present had seen proved cases of lipoid pneumonia. Dr. Copeland then admonished strongly against indiscriminate use of oily nose drops but added that the danger of a vigorous baby's getting emulsified oil into the respiratory tract was very slight. To Dr. Hardin's (Maplewood, N. J.) suggestion as to B_1 in constipation and anorexia, Dr. Copeland said he saw no danger and did think B_1 and the B complex were definitely helpful in anorexia.

General Feeding.—To Dr. McGuire's (Homestead, Pa.) question as to the daily allowance of 13 ounces of evaporated milk being sufficient, Dr. Copeland answered that while this amount is usually enough, there is no objection to using more, but the diet should be reinforced with cereal when 13 ounces seems insufficient. To Dr. Fairfax Hall (New Rochelle) he replied that evaporated milk is the answer to the pediatrician's prayer, and its use may be continued until the baby wears long trousers.

Evaporated milk obviates the use of cereal gruels formerly used in the early days. Practically all the physicians present used evaporated milk as first choice in normal artificially fed infants. Evaporated milk was also the answer to Dr. Bond (Wheeling) in that freezing on the doorstep is not a problem as with bottled milk, which frozen milk should not be used. Dr. Garrison (Jackson, Miss.) was advised that the relative fat content of evaporated milk could be reduced by the addition of dryco. In regard to the very early feeding of cereals and vegetables asked by Dr. Zeligs (Cincinnati) and Dr. Bronstein (Chicago), Dr. Copeland thought that allergy and its bad effects should be kept in mind and saw no advantage in giving vegetables before 5 months.

Premature Infants.—Dr. Gipson (Gadsden, Ala.) asked about vitamin B in premature babies and Dr. Weston (Columbia, S. C.) about vitamin C in breast-fed and bottle-fed babies. Dr. Hess recommended the starting of orange juice at 2 to 3 weeks; ascorbic acid is all right in those sensitive to orange juice, but he added that its prolonged use should be avoided as it is not a complete substitute. Vitamin D is to be started at 4 weeks, and iron also is to be started at 4 weeks as iron and ammonium citrate and egg yolk. Dr. Hess stated he was unable specifically to give results on the use of vitamin B. Dr. Hess also advised in answer to the question of Dr. Kennedy (Birmingham) that breast milk may be modified with skimmed sour milk to give a higher protein content for better gains but stressed the point that a small gain in premature infants should be considered satisfactory. Forced feeding is to be avoided. For the first month the caloric intake should as a rule not exceed 100 calories per day.

General.—To Dr. Fine (Perth Amboy, N. J.) Dr. Hess replied that the use of alcohol in the nursing mother did not present a problem but that cigarettes should probably be considered as of importance.

Both Drs. Gengenbach and Hess favored keeping the baby in the mother's room but recognized the difficulties, if not the impossibility, of doing this in the modern hospital, in answer to Dr. McCall's (Detroit) query as to how to promote a better contact between mother and infant with the objective of increasing the number of breast-fed babies. Dr. Stringfield (Stamford) asked the proper recommendations to the mother during prenatal period for adequate preparation of the nipples for breast feeding. Dr. Hess advised massage of the breast and the nipples with the aid of cocoa butter. Castor oil and balsam of Peru was presented as the best remedy for fissures of the nipples in answer to Dr. VanOrder (Chat-

tanooga). Dr. Hess stated that goat's milk has a real place in the management of cow's or mother's milk, and also reported a case of celiac disease cured with goat's milk. Dr. Gengenbach admonished against the too frequent changing of the formula in those infants not eating well. In closing, he stated that every effort should be made to keep the baby on breast milk, and to teach the mother the care and preparation of the breast. Only when breast milk is not available, should bottle feedings be employed. Pasteurized or sterilized milk is essential to prevent undulant fever, tuberculosis, or the direct contamination with streptococcus and other organisms.

Respectfully submitted,

R. W. HOLT AND J. J. DONAHUE.

Academy News

The following Academy committees have been appointed since the meeting in Cincinnati:

Nominating Committee

Chairman, Horton Casparis, Nashville, Tenn.
Jay I. Durand, Seattle, Wash.
Lee Forrest Hill, Des Moines, Iowa
Oliver L. Stringfield, Stamford, Conn.

Committee on Vitamins

Chairman, Allan Butler, Boston, Mass.
Frederick F. Tisdall, Toronto, Ont.

Committee on Honorary Members

Chairman, Kenneth Blackfan, Boston, Mass.
Isaac A. Abt, Chicago, Ill.
Rustin McIntosh, New York, N. Y.
Edwards A. Park, Baltimore, Md.

Committee on South and Central American Fellowships

Chairman, Henry F. Helmholz, Rochester, Minn.
A. Graeme Mitchell, Cincinnati, Ohio
Fred W. Schlutz, Chicago, Ill.

Committee on Periodic Examinations

Chairman, Hugh Chaplin, New York, N. Y. (not complete; appointments for this Committee, to assist Dr. Chaplin, to be made later).

Historian

Ernest Caulfield, Hartford, Conn.

Committee on Pediatric Awards

Chairman, Henry F. Helmholz, Rochester, Minn.

Dr. Isidor H. Tumpeer of Chicago died Nov. 29, 1939.

Dr. Arthur H. London, Jr., has been appointed state chairman of North Carolina to replace Dr. Aldert S. Root.

Dr. Fred P. Webster of Portland has been appointed state chairman for Maine.

Dr. Otto L. Goehle, Lakewood, Ohio, has been authorized by the Executive Board of the Academy to make a survey of pediatric practice.

The Executive Board of the Academy has renewed its contract for publicity with Mr. Lawrence H. Selz for one year.

Dr. Ralph W. McKelvy, Los Angeles, Calif., has been elected to Fellowship in the Academy.

News and Notes

The following were certified by the **American Board of Pediatrics** after the examinations in Cincinnati on Nov. 14 and 15, 1939.

Dr. Marion Leroy Ainsworth, Columbus, Ohio
Dr. Philip L. Aries, Chicago, Ill.
Dr. William James Ball, Charleston, S. C.
Dr. Ruth Berrey, Birmingham, Ala.
Dr. Mercer Blanchard, Columbus, Ga.
Dr. Olga Bonke-Booher, Indianapolis, Ind.
Dr. David John Bradley, Cincinnati, Ohio
Dr. Charles Pugh Brown, Norfolk, Va.
Dr. Clyde Dummer, Cincinnati, Ohio
Dr. J. Gilbert Eblen, Knoxville, Tenn.
Dr. Lena Stafford Enright, Findlay, Ohio
Dr. Seymour Fisher, Normal, Ill.
Dr. Wilbur Jerome Fisher, Buffalo, N. Y.
Dr. Thos. G. Folsom, Huntington, W. Va.
Dr. Hugh Mason Foster, Toledo, Ohio
Dr. Michael Leo Furcolow, Washington, D. C.
Dr. John Leo Gedgoud, Chicago, Ill.
Dr. Clarence E. Gilmore, Paris, Texas
Dr. Edward A. Hagmann, Billings, Mont.
Dr. L. J. Halpern, Chicago, Ill.
Dr. James Mace Harkey, Boston, Mass. (formerly of Chicago)
Dr. Barbara Ann Newell, Cincinnati, Ohio
Dr. Benjamin Ervin Hodge, Clarksburg, W. Va.
Dr. Stanley V. Laub, Detroit, Mich.
Dr. Margaret A. Limper, Louisville, Ky.
Dr. Emanuel Shalit Lippman, Minneapolis, Minn.
Dr. Sol Londe, St. Louis, Mo.
Dr. Kenneth C. Macpherson, Detroit, Mich.
Dr. Meyer B. Marks, Miami, Fla.
Dr. William Taylor Maxson, Lexington, Ky.
Dr. Masters H. Moore, Tyler, Texas
Dr. Daniel J. Pachman, Chicago, Ill.
Dr. J. Cyril Peterson, Nashville, Tenn.
Dr. William M. Petty, Pittsburgh, Pa.
Dr. Samuel X. Radbill, Philadelphia, Pa.
Dr. Frederick Walter Rea, Marion, Ohio
Dr. Eli Rubens, Chicago, Ill.
Dr. Nelson Wm. Ryan, Cincinnati, Ohio
Dr. M. I. Saberman, Chicago, Ill.
Dr. Thomas Paine Saltiel, Chicago, Ill.
Dr. Kennith Witwen Schmidt, Denver, Colo.
Dr. Louise Friedaricka Schnute, East Lansing, Mich. (formerly of Ann Arbor)
Dr. H. Vaughn Scott, Fort Wayne, Ind.
Dr. Abraham B. Schwartz, Milwaukee, Wis.
Dr. Hyman A. Slesinger, Windber, Pa.
Dr. Daniel Lesesne Smith, Jr., Spartanburg, S. C.
Dr. Maurice Acobert Spalding, Milwaukee, Wis. (formerly of Chicago)
Dr. James Walker Stirling, Pittsburgh, Pa.
Dr. Jack Ezell Strange, New Orleans, La.
Dr. Charles Klaus Stulik, Chicago, Ill.
Dr. Arthur R. Turner, Chicago, Ill.
Dr. Charles Edward Ward, Jackson, Miss.
Dr. Thomas S. Weaver, Cincinnati, Ohio
Dr. Hugh Wellmeier, Piqua, Ohio
Dr. Warren Elwell Wheeler, Lansing, Mich.
Dr. Lynn W. Whelchel, Miami, Fla.
Dr. Scott J. Wilkinson, Decatur, Ill.
Dr. Carl Edward Zeithaml, Cleveland, Ohio

The **American Board of Pediatrics** will hold examinations in 1940 as follows: The last date at which application may be filed is also given.

New York	April 30, May 1	Closed
Kansas City	May 18	Last date, February 1
Seattle	June 21	Last date, February 2
Memphis	November 17	Last date, July 17

At the forthcoming annual session of the **American Medical Association** in New York City, June 10 to 14, 1940, the meetings of the Section on Pediatrics will be held in the ballroom of the Waldorf-Astoria hotel. The banquet of the Section on Pediatrics will also be held at the hotel on Thursday evening, June 13. The headquarters of the Section on Pediatrics will be at the Waldorf-Astoria, and the scientific and commercial exhibits at the nearby Grand Central Palace.

Calendar of Pediatric Meetings 1940

January			
18-20	Thu.-Sat.	Fourth White House Conference	Washington, D. C.
March			
22-23	Fri.-Sat.	Meeting Region II, Academy of Pediatrics	Edgewater Park, Miss.
April			
4-6	Thu.-Sat.	Meeting Region I, Academy of Pediatrics	Washington, D. C.
30	Tue.	Examination, Board of Pediatrics	New York
May			
1	Wed.	Examination, Board of Pediatrics	New York
1-2	Wed.-Thu.	Annual Meeting, Society for Pediatric Research	Skytop, Pa.
2-4	Thu.-Sat.	Annual Meeting, American Pediatric Society	Skytop, Pa.
16-17	Thu.-Fri.	Meeting Region III, Academy of Pediatrics	Kansas City, Mo.
18	Sat.	Examination, Board of Pediatrics	Kansas City, Mo.
30-31	Thu.-Fri.	Meeting Region IV, Academy of Pediatrics	Seattle, Wash.
June			
1	Sat.	Meeting Region IV, Academy of Pediatrics	Seattle, Wash.
2	Sun.	Examination, Board of Pediatrics	Seattle, Wash.
12-14	Wed.-Fri.	Section on Pediatrics, A. M. A.	New York
November			
17	Sun.	Examination, Board of Pediatrics	Memphis, Tenn.
18-20	Mon.-Wed.	Annual Meeting, Academy of Pediatrics	Memphis, Tenn.

Book Reviews

Hospital for the Ruptured and Crippled. Fenwick Beekman, M.D. Privately printed by the hospital, 321 East 42nd St., New York, on the occasion of the Seventy-Fifth Anniversary of the Hospital, 1939. 157 pages. Price $3.00.

Not only is this book an excellently prepared and written history of the 75 years of the Hospital, but also it is important as the story of the development of orthopedic surgery in America, and the developmental trends in surgery during the life of the hospital. Chapters are devoted to the founding of the hospital in 1863 and the work of Dr. James Knight; the development and changes under Dr. Virgil Gibney, who was in charge from 1887 to 1924; and the era of Dr. Coley and Dr. Royal Whitman. One is impressed by the way in which the management and staff during this time met changing conditions and the problems which arose from the development of medical science and technic. Dr. Beekman is to be congratulated on writing a history of interest to physicans who have had no connection or touch with the institution.

Infantile Paralysis. Vol. A 40. International Bulletin for Economics, Medical Research and Public Hygiene. Published and Distributed in the United States by the National Foundation for Infantile Paralysis, Inc., 120 Broadway, New York, 160 pages.

A splendid group of twenty-two authoritative papers covering our present-day knowledge of poliomyelitis. The status of etiology and epidemiology as well as the treatment of acute and paralytic cases is included. Among the American contributors are Aycock, Trask, Sabin, Toomey, Irwin, and Bennett; among the foreign, Lepine of France, Arthus of Switzerland, and Gauvain and MacNalty of England. The Foundation is to be thanked for making so readily available the latest developments in the prevention and treatment of infantile paralysis.

Pediatrics and Pediatric Nursing. A. Graeme Mitchell, M.D., Echo Kupham, R.N., and Elgie M. Wallinger, R.N., Philadelphia, 1939, W. B. Saunders Co., 575 pages.

The text, based on the teaching of nurses at the Children's Hospital at Cincinnati, is in keeping with present-day conceptions of nursing education, i.e., the nurse should be considered as "an intelligent partner of the physician." If you are in sympathy with this trend the book is well balanced and excellent; if you disagree, there is an overabundance of medicine and all too little nursing. The reviewer must consider the book from the first viewpoint as this is the one from which it is written.

The contents are divided into a group of units and these in turn into appropriate chapters. Unit I contains an excellent brief summary of physical and mental growth. Unit II covers nutrition, Unit III hospitals, etc.; and Units IV, V, VI, and VII (286 pages in all) are given to descriptions of diseases. Unit VIII (62 pages) is headed "Pediatric Nursing." Each chapter is followed by questions which bring out the essential points of the text. The book is well written and clear and the illustrations are numerous and excellent, if occasionally more picturesque than important. It is a text well suited for teaching purposes in our university schools of nursing where there is a good hospital for children in af-

filiation, and where the nursing education points to the training of nurses for ward and executive positions. The chief fault of the book is the emphasis on hospitals and institutions, and the lack of interest, or discussion, of the problems of the home nursing of children. Many pediatricians feel that sick children do much better at home than in the hospital and that hospitalization should be limited as far as possible to surgical conditions, diagnostic problems, and the care of children who for environmental reasons cannot obtain good care in the home. So many splendid nurses are such failures when it comes to nursing children, that perhaps the fundamental problem of a good nurse for children is one of birth rather than training.

Common Procedures in the Practice of Paediatrics. Alan Brown, M.D., and Frederick F. Tisdall, M.D., Toronto, 1939, McCelland and Stewart. New edition, 314 pages. Price $5.00.

A revised and enlarged edition of the diagnostic, therapeutic and dietetic methods in use at the Hospital for Sick Children, Toronto, which has long been recognized by pediatricians for the thoroughness of its clinical work. Its clearness and conciseness make it of particular value to the student and house officer. Its chief value to the pediatrician lies in making readily available for quick reference a large number of tables and descriptions of methods. It is a book that could well be added to the libraries of our children's hospitals.

Pneumonia: With Special Reference to Pneumococcus Lobar Pneumonia. Roderick Heffron, The Commonwealth Fund, New York, 1939. 1104 pp.

The book is well described in the second paragraph of the preface as follows: "The present book, the third of the series planned, presents a comprehensive discussion of pneumonia with special reference to pneumococcus lobar pneumonia and measures for treatment. The more important findings resulting from the Massachusetts Pneumonia Study have been incorporated in the text. In the preparation of this volume much of the literature relating to pneumonia was reviewed and abstracted in detail. Most of the pertinent older literature deals with pneumonia in various of its anatomic forms, while bacteriologic diagnosis, when mentioned, is often considered only as a secondary matter. Therefore it has not always been possible to give as much emphasis to etiologic diagnosis as the importance of the subject makes desirable. The bibliography is not of course "complete"; the first three series of the *Index-Catalogue of the Library of the Surgeon-General's Office, United States Army*, give the titles of approximately ten thousand articles and books on the pneumococcus and pneumonia. However, it is believed that practically all the more important discussions through 1936 are referred to in the text and listed in the bibliography. Certain studies published since 1936 are also included."

The work is of high character throughout, and everyone interested in the general problem of pneumonia will need a copy in his library. The special features of pneumonia in infants and children are discussed as adequately as the data in the literature permit, but the volume will impress pediatricians that pneumonia in infancy and childhood is more complicated than pneumonia in general medical practice.

James D. Trask.

Comments

THE COUNCIL FOR PEDIATRIC RESEARCH

This Council, essentially a special committee of the Academy of Pediatries, presented at the Academy meeting in Cincinnati its final report for the trial period covered by a grant from the Carnegie Corporation of New York. This report, while perhaps disappointing from the financial point of view, indicated clearly that there are important possibilities in the Council's plan of operation, and that a continuance of its activities, accompanied by a search for more reliable methods of financing them, is highly desirable.

The Council's work has been along several lines. Its first effort, which has been continuous, was to obtain as complete information as possible, by means both of personal visits and responses to questionnaires, regarding research facilities in pediatric clinics and laboratories in the United States and Canada. This information covers equipment, including financial support and its sources; and personnel, their training and special interests; and research in progress, contemplated or possible when funds are available. While the data are not actually complete, there is at hand a really excellent directory of these clinics and laboratories, cross-indexed to make such information readily available. A similar effort has been made to become acquainted with leading manufacturers of pharmaceuticals, foods, etc., who cater to the pediatric trade, and who are potential sources of grants for research. Agreeable relations have been established with many such firms. Attempts to establish connections with philanthropic foundations or individual philanthropists who might subsidize research through the Council have not so far been especially successful.

The chief aim of the Council has been, of course, to obtain grants for research to be allocated by the Council to clinics and laboratories best fitted to handle the particular project in view. Progress in this line was slow, as was to be expected. During the first year of the Council's existence a number of inquiries were received, but little practical was accomplished. During the second year more tangible results were obtained, and at the end of the trial period the Council has to its credit a number of important grants from such well-known companies as Mead, Johnson and Co., the Borden Company, Schering & Glatz, and the Staley Manufacturing Company. These grants have totaled approximately $22,500.00 of which $20,000 has gone to the clinics and laboratories, and $2250 to the Council in fees for its services. These grants have been of great

importance to the recipients. In nearly every case they have helped to keep in operation clinics rather hard pressed for funds, and in every instance have enabled promising young investigators to continue their studies when otherwise they might have been obliged to drop them and take to practice. The Council has in several cases been able to assist the donor by advice as to the type or the details of the investigation to be followed, and has been of service in guiding studies into lines which promise information of real scientific value as well as serving the immediate commercial purpose of the donor.

The plan of supporting the Council and collecting "free funds" for research by fees charged to donors of grants has not been wholly satisfactory. It is perfectly legitimate in the case of firms which need the kind of assistance which the Council is in position to render, but does not appeal to those who have competent research directors of their own. There is, however, a definite understanding on the part of such firms that, aside from the humanitarian motive, they have an important financial stake in the constant progress of research, even outside of their special fields; and that, as support of investigation by foundations and private philanthropies continues to decline, we must look more and more to commercial sources for a constant supply of funds for research activities. In its search for more certain means of support, the Council is considering an appeal to some of the most prominent of these firms and associations, most of which spend money freely for research, to contribute regularly to the support of the Council's activities rather than helping it by an occasional, sometimes really unnecessary, fee. Some of the companies have been approached regarding such a plan, and have seemed to look on it with approval.

The Academy of Pediatrics has shown itself sufficiently convinced of the soundness of the Council's ideas to vote it funds which will enable it to carry on until July 1, 1940. It should be possible in this period to determine what is the best method for future operation.